ESSAYS ON RISK BIASED EXPORTS AND LIQUIDITY-BASED DETERMINANTS OF INTERNATIONAL EQUITY FLOWS

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This dissertation is comprised of three essays. Chapter One develops a general-equilibrium framework to address risk-shifting factors in a country allocation of resources between the domestic and export sector. The analytical framework introduces credit frictions as in Allen and Gale (2000) to the general equilibrium model of Helpman and Razin (1978), which features the allocation of factors of production across two sectors of an open economy under uncertainty. The risk bias hinges on the imperfect ability of lenders to monitor the usage of the borrowed funds. Borrowers would invest more on the equities of the risky production sector. This is because if the returns of those equities are high, they would repay the promised return and keep the remaining profits from their investment. However, if the returns are low, they can just default and avoid further losses. Such risk-shifting behavior, which tends to make the risky (export) sector equities overpriced, will lead to also to overinvestment in this sector, and excessive allocation of labor to it. As a result, the production and export pattern to be geared towards the risky sector, which may expose a country to increased macroeconomic volatility.

Chapter Two provides an empirical test to key predictions of the theory, which is developed in Chapter One. Specifically, it uses cross-country panel data to test whether low degree of monitoring borrowers by financial intermediaries would contribute to a shift in a country's exports towards risky production sectors. It analyzed the data measuring the riskiness across sectors, developed by Koren and Tenreyro (2007) and Di Giovanni and Levchenko (2011), from developed and developing economies over the period of 1978-2004. The explanatory variable of interest is the creditor rights index (CRI) because it captures the degree of enforcing debt repayment and thus reflects the lenders' ability to observe the borrowers'

actions. The dependent variable is the risk content of exports index, which is constructed by multiplying the square of each sector's share of exports to the variance of the sectoral value added growth. The higher value of the index indicates that a country has higher shares of exports in the sectors whose productions are more volatile. Using fixed effects regressions, the results revealed that countries where lenders have lower ability to monitor borrowers are the ones with higher risk content of exports. This finding remained robust even after excluding the most volatile production sectors from the analysis. And when separately examining the effects of the four different components of creditor rights index, it is shown that the effects of creditor rights arises from the restrictions on the borrowers' filing for reorganization.

Chapter Three, addressing international equity flows, provides empirical tests to three theory-based hypotheses concerning foreign equity investment in the presence of liquidity risk. First, the FDI-to-FPI price differential is negatively related to liquidity risk (the "Price Discount Hypothesis"). The idea is that direct investments would incur a price discount because market participants do not know whether the FDI investor liquidates a firm because of an idiosyncratic liquidity shock, or because, as an informed investor, the firm is hit by a productivity shock. Second, the FDI-to-FPI composition would skew towards FPI if investors expect to experience liquidity shortage in the future (the ""Equity-Composition Hypothesis"). Since direct investments are more costly to liquidate, due to the price discount, investors would be inclined to hold less FDI if they expect more severe liquidity shock. The third hypothesis, on the other hand, states that the FDI-to-FPI composition would skew towards FDI if the past FDI-to-FPI stocks were larger (the "Strategic Complementarity Hypothesis"). If the initial proportion of direct investments is higher, it is more likely that a direct investment is sold due to liquidity needs. This improves the price of the prematurely sold direct investment, creating an incentive for more investors to choose FDI rather than FPI. These hypotheses are examined using the country level data consisting of a large set of developed and developing countries over the period 1970 to 2004. The nationwide sales of external assets are used as a proxy for liquidity problems, and the

effect of expected liquidity problems on stock prices, the ratio of FPI to FDI and gross flows of FDI and FPI are tested. The empirical results support the three hypotheses.

BIOGRAPHICAL SKETCH

Anuk Serechetapongse was born in December 1984. She attended Kasetsart University Laboratory School, International Program, for her elementary and secondary education where she graduated high honor. She went to further her study at the Bachelor of Arts Program in Economics (EBA), Chulalongkorn University where she graduated First Class Honors-Top of Class. She started working as an economist at the Bank of Thailand in 2007. She was awarded the Japan-IMF Scholarship Program (JISP) for Advanced Studies when she first came to the Department of Economics at Cornell University. She was the only Thai who was awarded the scholarship since that year. She earned a Master of Arts degree in Economics in 2011, and her Ph.D. was completed in August 2013.

To my beloved Serechetapongse family and Niratisayakul family.

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CHAPTER 1

Risk-Biased Exports: the Role of Creditors' Protection (A Theoretical Framework)

I. Introduction

A number of economic crises, such as the 1997 Asian crisis and the 2007 US crisis, were triggered by disruptions in financial markets and overshooting in asset prices. What could cause such overshooting? Also, what are some possible implications of a disruption in financial market on the real sector?

One strand of literature, such as Turnovsky (1974), Helpman and Razin (1978), Grossman and Razin (1985), Helpman (1988), and Koren (2003) portrayed the determinants of trade patterns under uncertainty. Recently, Di Giovanni and Levcheko (2011) used the framework of Turnovsky (1974) to outline the relationship between comparative advantage and exports of a risky good versus a safe good. However, none of them address the effects of the problems in the financial sector, such as when borrowings are not monitored. Another strand of literature, such as Allen and Gale (2000), illustrated the mechanism through which the lack of monitoring in the financial sector gives rise to asset price overshooting, but they did not give insights about the implications on production and exports. This paper is one among few papers that connect these two strands of literature by combining the real sector framework of Helpman and Razin (1978) and the financial sector framework of Allen and Gale (2000) in order to investigate the relationship between the ability of lenders to observe borrowers' usage of funds and the export patterns.

In Helpman and Razin, goods are always traded internationally, but they mentioned both when there is no international trade in equities and when equities are traded internationally. But,

like Di Giovanni and Levchenko, this paper only explores a case when there is an international trade in goods but not in equities. As explained in Di Giovanni and Levchenko, it is still valid to consider this case since there is no strong empirical evidence for international risk sharing via financial liberalization.

Nevertheless, the driving mechanism of a model in this paper is different from that of Di Giovanni and Levchenko. In their framework, production diversification serves as a mean of risk diversification. Thus, shifting the joint probability distribution of the productivity shocks by preserving the spreads but changing the mean of the shocks in favor of one sector (thereby increasing its comparative advantage) would increase the production of that sector. In contrast, the production pattern in this paper's framework is driven by the risk-shifting behavior that occurs due to the lack of monitoring in the borrowing usage.

Such mechanism is adopted from Allen and Gale (2000). In their model, investors borrow from banks to invest in the safe and the risky assets. While the safe asset is in variable supply and provides a stable return, the risky asset is in fixed supply and provides a random return. It is assumed that banks do not know how to invest in the safe and risky assets, so they have no choice but to lend to investors, and they cannot observe the investment decisions of investors after lending. Also, banks and investors cannot condition to terms of the loan on the size of the loan or on asset returns, which caused them to use simple debt contract only. The assumption that banks cannot monitor the investors' usage of borrowing would give rise to the risk shifting behavior among investors. If their portfolio value is insufficient for repayment, they can just declare bankruptcy and avoid further loss. But if their portfolio value turns out to be high, they would just repay the bank the promised return and keep the rest of the proceeds. Thus, investors would substitute towards the risky asset. And since the risky asset is in the fixed

supply, the higher demand from investors would bid up the price of the risky asset to be above its fundamental value.

This chapter extends the partial equilibrium model in Allen and Gale (2000) to the general equilibrium set-up and uses the similar mechanism described above to illustrate the effects of the lack of monitoring in the borrowing usage on asset price as well as on production and exports[1].

From a theoretical framework, this paper hypothesizes that when investors cannot be fully monitored, they could engage in risk-shifting behavior in asset market, resulting in asset price overshooting. Investor's risk-shifting behavior would at the same time increase investment in a production sector that is more susceptible to shocks, pushing up the production and exports in such sector. An empirical test in the next paper also supports that countries with lower degree of creditors' protection are the ones whose exports are more geared towards sectors with higher volatility in production. This could lead to a possible policy implication that countries with weak supervision in financial sector and more likely to experience higher output volatility.

The rest of this chapter is organized as follow. Section II describes a theoretical model, Section III reveals the results from simulations, and Section IV concludes.

II. A Model

To investigate a possible linkage between the real sector and the financial sector, the real sector framework of Helpman and Razin (1978) and the financial sector framework of Allen and Gale (2000) are combined to form a 2-period, 2-sectors, small open economy model. The

[1] The model in this chapter relaxes the assumptions in Allen and Gale (2000) that investors are risk neutral and that there is a non-pecuniary cost which restricts the size of investment.

production of the first sector, the risky sector, is subject to a productivity shock, whereas the production of the second sector, the safe sector is not. The price of the safe good is normalized to 1, so the price of the risky good, denoted by P, captures the relative price of risky good to safe good. There is an international trade in both goods, causing the price of goods to be exogenous. However, there is no international trade in stocks.

1. The Production Sectors

There are two production sectors, the risky sector and the safe sector. They use labor and capital to produce and issue stocks in the first period. Then they sell output and provide returns to stockholders in the second period.

1.1 The Risky Production Sector

The production of the first sector, the risky sector, is subject to a random productivity shock. The actual output of the risky sector is

$$\theta Z = \theta F(L_Z, K_Z)$$

where the subscript Z denotes the risky production sector. In the above equation, $Z = F(L_Z, K_Z)$ is a standard homogenous of degree one production function. L_Z and K_Z are the labor and capital input for the risky sector, respectively. The variable θ is a random variable with a continuous positive density $h(\theta)$ on the support $[0, \theta_{MAX}]$ and mean $\bar{\theta}$. The random productivity shock θ is common knowledge, and the actual value of θ will realize in the second period.

Before the productivity shock realizes, the optimal amount of both factors of production must be chosen in the first period. The producers of the risky good also issue "real equities", or stocks, to finance their factor costs. (A real equity from the risky sector will be called a risky

equity.) A unit of risky equity in the first period provides a basket of (θ(1), θ(2),…..) units of risky good, covering all states of nature.

Since firms choose factor input before the realization of productivity shock, their optimization can be done via maximizing their stock market value (maximizing their stock market value is equivalent to maximizing their profits if there is no productivity shock). Thus, the firms' optimization problem can be written as follow

$$max\ qZ - R_Z K_Z - W_Z L_Z = max\ q\ F(L_Z, K_Z) - R_Z K_Z - W_Z L_Z$$

where q is the selling price of a risky equity, and Z can also be seen as the total amount of issued risky equities. RZ is the rental rate and the W_Z is the wage rate offered by the risky sector.

In the second period after the productivity shock realizes, a holder of one unit of risky equity will be given θ units of risky good as a return, and the monetary value of such return is $P\theta$.

1.2 The Safe Production Sector

In contrast, the production of the second sector, the safe sector, is not subject to a productivity shock. Therefore, the profit maximization for firms in the safe sector can be written as follow

$$max\ X - R_X K_X - W_X L_X = max\ Q(L_X, K_X) - R_X K_X - W_X L_X$$

where the subscript X denotes the safe production sector. In the above equation, $X = Q(L_X, K_X)$ is a standard homogenous of degree one production function with labor input L_X and capital input K_X. Note that the price of the safe good is normalized to 1. R_X is the rental rate and the W_X is the wage rate offered by the safe sector.

Like firms in the risky sector, firms in the safe sector issue real equities to finance their factor costs. Because there is no productivity shock in the safe sector, the above profit maximization problem can also be viewed as stock market value maximization problem. It can be interpreted that the selling price of each unit of real equity for the safe sector (henceforth, safe equity) is normalized to 1.

Because the production of a safe sector is not subject to shocks, safe equity yields a constant return in all states of nature. The return on each unit of safe equity equals the marginal product of capital, R_2, which is equal to the depreciation rate plus the risk-free interest rate r. It is assumed further that the depreciation rate is zero, so each unit of safe equity provides a constant return of r units of safe good in the second period.

2. The Household Sectors

There are two types of households, workers and entrepreneurs, both of which will consume only in the second period. Workers, which have no access to the stock market, supply the loans by depositing their labor income in the banks. In contrast, entrepreneurs are the ones who have access to the stock market and demand loan. Thus, they will play an important role in determining the price of real equities as well as resource allocations among production sectors. This is different from the set-up in Allen and Gale (2000) where there are investors and banks but the source of the banks' funds is not mentioned.

2.1 Household Sector: Workers

In the first period, workers are endowed with total amount of labor $\overline{L}$, so they will earn labor income from allocating their labor endowment between the risky sector and the safe sector.

Because they want to maximize their income for their second-period consumption but have no access to the stock market, they will deposit all their labor income, $W_Z L_Z + W_X L_X$, in a bank in the first period to get the second-period return $r(W_Z L_Z + W_X L_X)$, where r is the interest rate. As a result, the labor income becomes the supply of loans available for borrowing.

2.2 Household Sector: Entrepreneurs

In the first period, entrepreneurs are endowed with total amount of capital $\overline{K}$, which would be allocated between the risky sector and the safe sector. They also own the firms in the two production sectors (by holding all initial real equities) and borrow from banks to invest in the real equities issued by both.

As for the relationship between borrowers and lenders, which in this case are entrepreneurs and banks, the following assumptions in Allen and Gale (2000) are employed to make the interaction between the risk-shifting behavior, asset price, and the real sector as clear as possible.

a. Banks are risk neutral.
b. Banks do not know how to invest in the safe and risky equities by themselves, so they have no alternatives other than lending to entrepreneurs.
c. Banks and entrepreneurs can only use simple debt contract. That is, they cannot condition the terms of borrowing based on the size of borrowing or on asset returns.
d. Entrepreneurs do not need collateral to borrow from banks

The first assumption is present in order for banks not to have preference towards or away from risk. The second assumption prevents banks from investing on their own. Hence, the actions of entrepreneurs can be observed more clearly.

Because the terms of loans are not conditioned on the loan size or asset returns, entrepreneurs can borrow as much as they want at the going lending interest rate. Then, in equilibrium, the lending interest rate would be equal to the risk-free interest rate, which is the return on the safe equity. If the lending interest rate is lower than the risk-free interest rate, entrepreneurs' demand for loans would be infinite. If the lending interest rate is higher, they will not invest in the safe asset at all. In other words, the demand for loans is perfectly elastic. Finally, since all the loans are non-collateral loans, banks can only claim the returns on entrepreneurs' portfolio performance but cannot go after their income from other sources, such as their income from endowment[2].

Entrepreneurs' first period budget constraint can therefore be written as follow:

$$x + qz \leq (qZ - R_Z K_Z - W_Z L_Z) + (X - R_X K_X - W_X L_X) + W_Z L_Z + W_X L_X$$

where x is the quantity of safe sector real equities purchased by entrepreneurs. Since the unit price of a safe sector real equity is 1, x also represents the total value of the purchased safe sector real equities. Similarly, z is the quantity of risky sector real equities purchased by entrepreneurs, so qz is the total value of the purchased risky sector. On the right hand side, $(qZ - R_Z K_Z - W_Z L_Z)$ and $(X - R_X K_X - W_X L_X)$ are the net values from their ownership of firms in the risky and the safe industries. The amount $W_Z L_Z + W_X L_X$, which is the deposited labor income, becomes the total amount of loans given to entrepreneurs.

In the second period, entrepreneurs would receive the rent on their capital endowment ($R_Z K_Z$ from the risky sector and $R_X K_X$ from the safe sector) and the return on their holdings of risky equities and safe equities. Following that the monetary return per unit of risky equity is $P\theta$ and the monetary return per unit of safe equity is r, the total return on entrepreneurs' portfolio is

[2] This assumption also prevents entrepreneurs' consumption to be equal to zero in the case that they default.

$$P\theta z + rx$$

Because the safe equities provide constant return in all states of nature, the outcome of entrepreneurs' portfolio would depend on the performance of the risky equities. Then entrepreneurs would repay to banks $r(W_Z L_Z + W_X L_X)$,which is the total amount of borrowing multiplied by the risk-free interest rate, before choosing the level of consumption. Nevertheless, the choices of investment and loan repayment made by entrepreneurs as well as the choices of consumption made by both entrepreneurs and workers hinge upon whether entrepreneurs' investment decisions can be monitored. This would also affect the price of the real equities and the actual productions of the real sectors.

3. The Lack of Monitoring Scenario versus the Full Monitoring Scenario

3.1 The Lack of Monitoring Scenario

This scenario illustrates the event when banks cannot monitor entrepreneurs' usage of borrowings, which would be followed by the risk-shifting behavior among entrepreneurs. If the productivity realization and hence the return on risky equities is high, entrepreneurs can repay the banks a promised return and keep the remaining proceeds from their portfolio. If the productivity realization is low and their portfolio values are insufficient to repay the bank, however, entrepreneurs would repay only the proceeds from their portfolio without bearing any further cost. This would encourage entrepreneurs to demand more risky equities, because they have more to gain on the upside risk and less to lose on the downside risk from investing in risky equities.

The entrepreneurs' optimization problem is to choose their capital allocations and portfolio allocations in the first period and then choose their consumption in the second period. This problem can be solved backward.

In the second period, entrepreneurs receive $R_Z^l K_Z^l + R_X^l K_X^l$ from renting capital to the two production sectors and get a total return of $P\theta z^l + r^l x^l$ from their portfolio. Then they must repay the amount $r^l\left(W_Z^l L_Z^l + W_X^l L_X^l \right)$ to the banks. This causes their total second-period income to be

$$R_Z^l K_Z^l + R_X^l K_X^l + P\theta z^l + r^l x^l - r^l\left(W_Z^l L_Z^l + W_X^l L_X^l \right)$$

where the superscript *l* indicates the lack of monitoring scenario. If the return on their portfolio is high, the above expression is positive because entrepreneurs would still earn positive profits even after repaying the banks.

If, on the other hand, the return on entrepreneurs' portfolio becomes insufficient for repayment, they would default and only pay the banks the total proceeds of their portfolio, $P\theta z^l + r^l x^l$, so their total second-period income equals

$$R_Z^l K_Z^l + R_X^l K_X^l$$

Formally, entrepreneurs' second period maximization problem in the lack of monitoring scenario can be written as follow:

$$max_{c_{Ze}^l(\theta), c_{Xe}^l(\theta) \geq 0} \quad u(c_{Ze}^l(\theta), c_{Xe}^l(\theta))$$

subject to

$$Pc_{Ze}^l(\theta) + c_{Xe}^l(\theta) \leq \max\{ R_Z^l K_Z^l + R_X^l K_X^l ,$$
$$R_Z^l K_Z^l + R_X^l K_X^l + P\theta z^l + r^l x^l - r^l(W_Z^l L_Z^l + W_X^l L_X^l) \}$$

Entrepreneurs maximize their utility by choosing their consumption of the risky good ($c_{Ze}^{l}(\theta)$) and of the safe good ($c_{Xe}^{l}(\theta)$) subject to their total income, which depends on their choice whether to default.

There exists a productivity shock realization θ^* such that entrepreneurs' income when default and not default are equated.

$$R_Z^l K_Z^l + R_X^l K_X^l + P\theta^* z^l + r^l x^l - r^l(W_Z^l L_Z^l + W_X^l L_X^l) = R_Z^l K_Z^l + R_X^l K_X^l$$

Rearranging the above equation yields

$$P\theta^* z^l + r^l x^l - r^l(W_Z^l L_Z^l + W_X^l L_X^l) = 0$$

Hence, θ^* is the threshold value of θ below which entrepreneurs will default on their loans. As a result, entrepreneurs' first-period maximization problem is as follow:

$$max_{K_Z^l, K_X^l, z^l, x^l \geq 0} \quad \int_0^{\theta^*} V\left(P, R_Z^l K_Z^l + R_X^l K_X^l\right) h(\theta) d\theta$$

$$+ \int_{\theta^*}^{\theta MAX} V\left(P, R_Z^l K_Z^l + R_X^l K_X^l + P\theta z^l + r^l x^l - r^l(W_Z^l L_Z^l + W_X^l L_X^l)\right) h(\theta) d\theta$$

subject to

$$x^l + q^l z^l \leq (q^l Z^l - R_Z{}^l K_Z{}^l - W_Z{}^l L_Z{}^l) + (X^l - R_X{}^l K_X{}^l - W_X{}^l L_X{}^l) + W_Z{}^l L_Z{}^l + W_X{}^l L_X{}^l$$

In the first period, entrepreneurs choose their allocation of capital among the two production sectors as well as their holdings of risky and safe equities to maximize their expected utility subject to their first-period budget constraint determined by the net values of their initial stock holdings and their borrowing from banks.

If entrepreneurs' usage of borrowing is not monitored, they would default when θ is lower than the threshold value θ^*, so the expected return per one unit of loan would be

$$rPr(\theta > \theta^*) + \int_0^{\theta^*} \left(\frac{P\theta z^l + r^l x^l}{W_Z^l L_Z^l + W_X^l L_X^l} \right) h(\theta) d\theta < r$$

It is observable that the expected return per one unit of loan will always be less than the contracted risk-free rate. Such difference can be viewed as an informational rent that entrepreneurs reap from workers, who are depositors, because they can hide their investment choices from banks.

As for workers, they will receive from banks the whole return on their deposits, $r^l\left(W_Z^l L_Z^l + W_X^l L_X^l\right)$, in the case of high productivity realization, and the proceeds $P\theta z^l + r^l x^l$ that is less than $r^l\left(W_Z^l L_Z^l + W_X^l L_X^l\right)$ in the case of low productivity realization. Thus, their second-period utility maximization can be written as

$max_{c_{Zw}^l(\theta), c_{Xw}^l(\theta) \geq 0} \quad u(c_{Zw}^l(\theta), c_{Xw}^l(\theta))$

subject to

$$Pc_{Zw}^l(\theta) + c_{Xw}^l(\theta) \leq \min\{ P\theta z^l + r^l x^l \ , r^l(W_Z^l L_Z^l + W_X^l L_X^l) \}$$

Workers maximize their utility by choosing their consumption of the risky good ($c_{Zw}^l(\theta)$,) and of the safe good ($c_{Xw}^l(\theta)$) subject to their total return on their deposits, which, again, depends on entrepreneurs' choice whether to default.

And their first-period maximization problem is

$$max_{L_Z^l, L_X^l, \geq 0} \quad \int_0^{\theta*} V(P, P\theta z^l + r^l x^l) h(\theta) d\theta + \int_{\theta*}^{\theta MAX} V\left(P, r^l(W_Z^l L_Z^l + W_X^l L_X^l)\right) h(\theta) d\theta$$

subject to

$$\bar{L} = L_Z^l + L_X^l$$

where workers choose their allocation of labor to maximize their expected utility subject to their resource constraint.

3.2 The Full Monitoring Scenario

The purpose of this scenario is to portray the fundamental value of the risky equity, which would serve as the benchmark to compare and tell whether the price of risky equity is overshooting. According to Allen and Gale (2000), the fundamental value is defined as the value that entrepreneurs would be willing to pay for one unit of risky equity if there is no risk shifting, all else equal[3]. This would occur if banks can fully monitor entrepreneurs' investment decisions. Therefore, entrepreneurs will repay in full regardless of the productivity shock realization. Entrepreneurs' second-period maximization problem in this scenario is the following:

$$max_{c_{Ze}^f(\theta), c_{Xe}^f(\theta) \geq 0} \quad u(c_{Ze}^f(\theta), c_{Xe}^f(\theta))$$

subject to

$$Pc_{Ze}^f(\theta) + c_{Xe}^f(\theta) \leq \{R_Z^f K_Z^f + R_X^f K_X^f + P\theta z^f + r^f x^f - r^f (W_Z^f L_Z^f + W_X^f L_X^f)\}$$

Hence, their maximization problem in the first period is as follow:

$$max_{K_Z^f, K_X^f, z^f, x^f \geq 0} \int_0^{\theta MAX} V\begin{pmatrix} P, R_Z^f K_Z^f + R_X^f K_X^f + P\theta z^f + r^f x^f \\ - r^f (W_Z^f L_Z^f + W_X^f L_X^f) \end{pmatrix} h(\theta) d\theta$$

subject to

$$x^f + q^f z^f \leq (q^f Z^f - R_Z^f K_Z^f - W_Z^f L_Z^f) + (X^f - R_X^f K_X^f - W_X^f L_X^f) + W_Z^f L_Z^f + W_X^f L_X^f$$

The superscript *f* denotes the full monitoring scenario.

The only difference between these maximization problems and the ones in the lack of monitoring scenario is that now there is no possibility of default.

[3] Allen and Gale (2000) also interpret the full monitoring scenario as a case that reveals the price of risky equity entrepreneurs are willing to pay if they use their own funds. Then they conjectured that if such entrepreneurs are introduced in the model, these entrepreneurs would hold less of the risky equity or even short the risky equity, depending on how risk-averse they are and on how severe the risk-shifting problem is. In order for asset price overshooting and the overinvestment in the risky sector to take place, there must be limitations on short sales of the assets.

Since entrepreneurs always repay to banks in full, workers will also get from banks the full return on their deposits, causing workers' second-period maximization problem to be

$$max_{c_{Zw}^f(\theta), c_{Xw}^f(\theta) \geq 0} \quad u(c_{Zw}^f(\theta), c_{Xw}^f(\theta))$$

subject to

$$Pc_{Zw}^f(\theta) + c_{Xw}^f(\theta) \leq r^f(W_Z^f L_Z^f + W_X^f L_X^f)$$

And their first-period maximization problem is

$$max_{L_Z^f, L_X^f \geq 0} \int_0^{\theta MAX} V\left(r^f(W_Z^f L_Z^f + W_X^f L_X^f)\right) h(\theta) d\theta$$

subject to

$$\bar{L} = L_Z^f + L_X^f$$

4. Equilibrium

In equilibrium, all domestic markets have to clear. The market-clearing conditions for labor and capital can be written as follow

$$\bar{K} = K_Z^j + K_X^j$$

$$\bar{L} = L_Z^j + L_X^j$$

The superscript $j = l, f$ denotes the lack of monitoring scenario or the full monitoring scenario. Because there is no international trade in real equities, the market-clearing condition for risky equities is

$$z^j = Z^j = F(L_Z^j, K_Z^j)$$

where the right-hand side is the demand for risky equities and the left-hand side is the supply of risky equities.

Similarly, the market-clearing condition for safe equities is

$$x^j = X^j = Q(L_X^j, K_X^j)$$

where the right-hand side is the demand for safe equities and the left-hand side is the supply of safe equities[4].

No-arbitrage condition implies that the wage rates and the rental rates offered by the risky sector and the safe sector must equalize. Hence,

$$W_Z^j = W_X^j = W^j, \text{ and } R_Z^j = R_X^j = R^j$$

The rental rate is equal to the sum of the interest rate and the rate of depreciation. It is further assumed that the rate of depreciation is zero, so

$$R^j = r^j$$

In addition, a production sector is in equilibrium if the net stock market value cannot be altered by varying its input levels. Thus, in an equilibrium in which all sectors produce a finite output level,

$$q^j \frac{\partial F(L_Z^j, K_Z^j)}{\partial L_Z^j} = W^j$$

$$q^j \frac{\partial F(L_Z^j, K_Z^j)}{\partial K_Z^j} = r^j$$

$$\frac{\partial Q(L_X^j, K_X^j)}{\partial L_X^j} = W^j$$

$$\frac{\partial Q(L_X^j, K_X^j)}{\partial K_X^j} = r^j$$

[4] This element is different from Allen and Gale (2000). In their partial equilibrium set-up, the supply of the risky equities is fixed at a certain value and the supply of the safe equities is determined by investors' decisions to invest in capital goods.

The first two equations are the first order conditions of firms in the risky industry, and the latter two are those of firms in the safe industry. Because $F(L_Z^j, K_Z^j)$ is homogenous of degree 1, multiplying $q^j \frac{\partial F(L_Z^j, K_Z^j)}{\partial L_Z^j} = W^j$ by L_Z^j and $q^j \frac{\partial F(L_Z^j, K_Z^j)}{\partial K_Z^j} = r^j$ by K_Z^j and adding them up yields

$$q^j Z^j = q^j F\left(L_Z^j, K_Z^j\right) = W^j L_Z^j + r^j K_Z^j$$

Since $Q(L_X^j, K_X^j)$ is also homogenous of degree 1, repeating the same steps using the first order conditions of the safe sector yields

$$X^j = Q\left(L_X^j, K_X^j\right) = W^j L_X^j + r^j K_X^j$$

This implies that the net values of owning the firms (net value of holding initial stocks) in both industries are zero. Using the above result and the no-arbitrage condition, the entrepreneurs' first-period budget constraint can be re-written as

$$x^j + q^j z^j = w^j \bar{L}$$

Then, when entrepreneurs' usage of borrowings cannot be monitored, the threshold value of productivity shock below which entrepreneurs will default (θ*) can be re-written as

$$P\theta^* z^l + r^l x^l - r^l w^l \bar{L} = P\theta^* z^l + r^l x^l - r^l (x^l + q^l z^l) = 0$$

$$\theta^* = r^l q^l / P$$

This means that the threshold value is positively related to the risk-free interest rate and the price of risky equity and is negatively related to the price of risky good. Thus, the higher price of the risky equity will push up the threshold value, increasing the likelihood the entrepreneurs will default.

Using the re-written first period budget constraint, the market clearing conditions, and the no-arbitrage conditions, the first order conditions of entrepreneurs' first period maximization when they cannot be monitored is

$$\int_{\theta*}^{\theta MAX} V'\left(P, r^l\overline{K} + P\theta Z^l + r^l X^l - r^l q^l Z^l\right)h(\theta)d\theta(P\theta - r^l q^l) = 0$$

The above equation will give the price of the risky equity when risk-shifting takes place. Similarly, the first order conditions of entrepreneurs' first period maximization when they can be fully monitored is

$$\int_{0}^{\theta MAX} V'\left(P, r^f\overline{K} + P\theta Z^f + r^f X - r^f q^f Z^f\right)h(\theta)d\theta(P\theta - r^f q^f) = 0$$

This equation will determine the fundamental price of the risky equity when there is no risk-shifting.

After the productivity shock realizes, the actual production level of risky good as well as the return on risky equity are determined. Then entrepreneurs and workers would choose their consumption of the safe and the risky goods. A good will be exported if the production level exceeds total consumption, and will be imported otherwise. Nevertheless, since there is no international trade in equities, the value of exports of one good must be equal to the value of imports of another good.

III. Simulation Results

The simulation results are shown in the figures below. Figure 1 reveals that the price of the risky sector's real equity is higher in the lack of monitoring scenario compared with its fundamental value in the full monitoring scenario. This result is in line with that of Allen and Gale (2000). Figure 2 illustrates that the production of the risky sector in the lack of monitoring scenario is higher than that in the full monitoring scenario. Moreover, the higher price of the risky sector's real equity and the higher production of the risky sector are associated with the higher price of the risky good. Finally, Figures 3 and 4 show that the volume and the value of

exports in the risky sector in the lack of monitoring scenario is higher than that in the full monitoring scenario. (Also, exports increase with higher productivity shock.)

The mechanism behind these results can be explained as follow. When borrowers, which in this case are entrepreneurs, cannot be fully monitored and thus can default, they would gear their investments towards the risky production sector by investing more in risky equities, given that they provide higher expected return compared with safe equities. This would bid up the price of risky equities in the low-quality credit market scenario to be higher than in the high-quality credit market scenario. At the same time, as entrepreneurs invest more in risky equities, the risky sector would receive higher level of investment, resulting in the higher production and export levels.

Figure 1: Price of Risky Equity

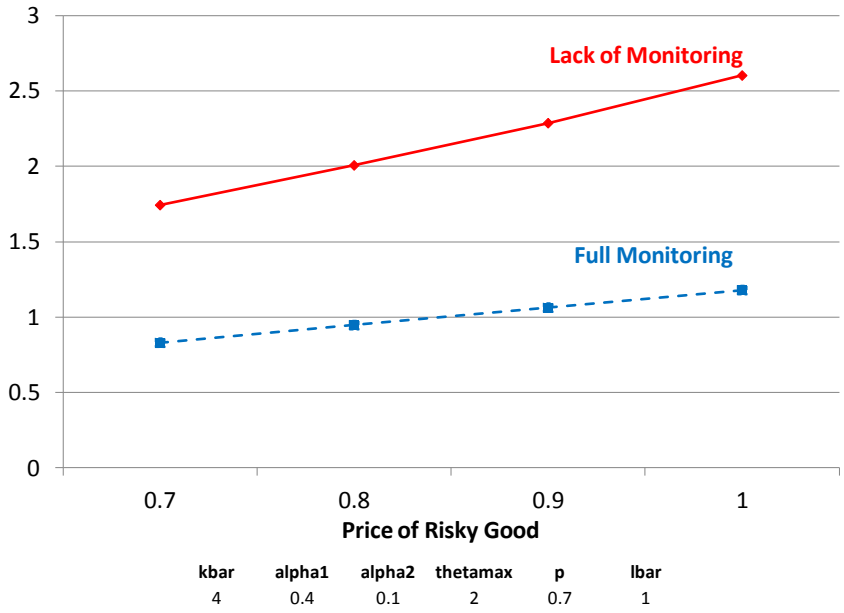
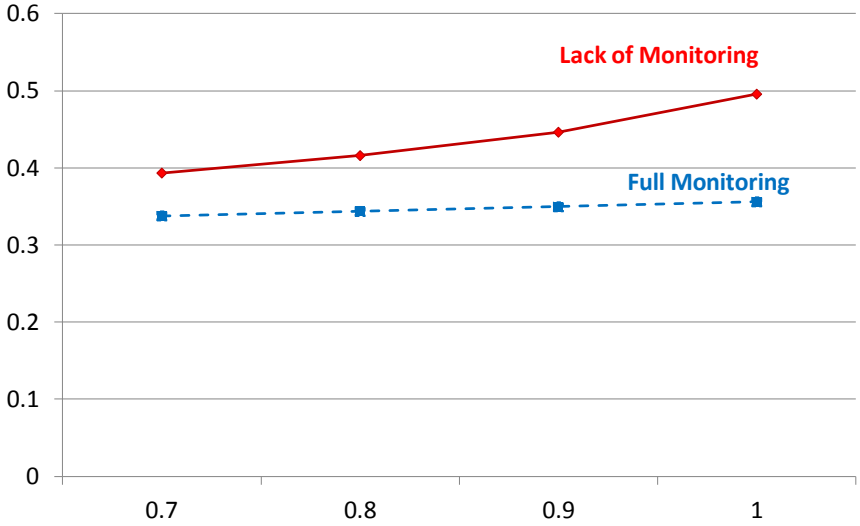
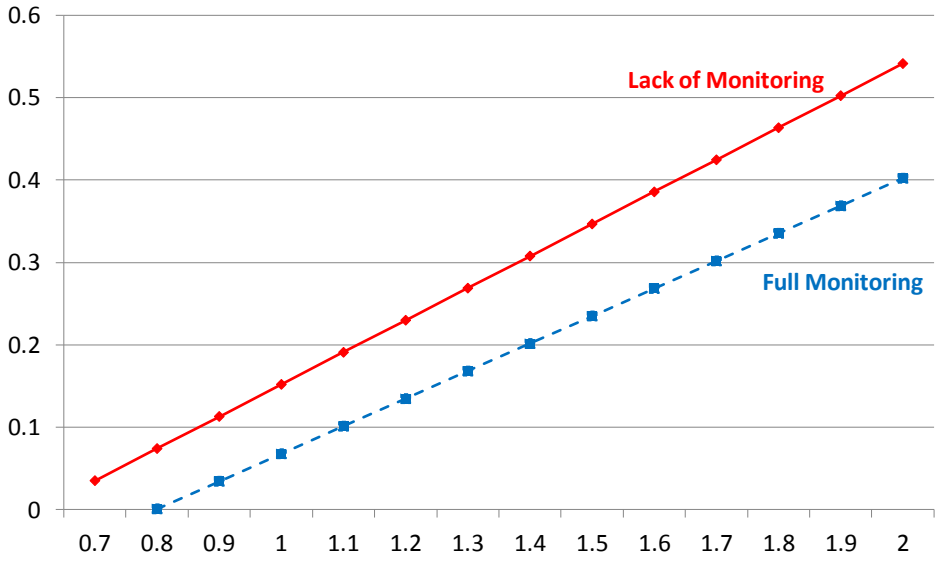


Figure 2: Production of Risky Good

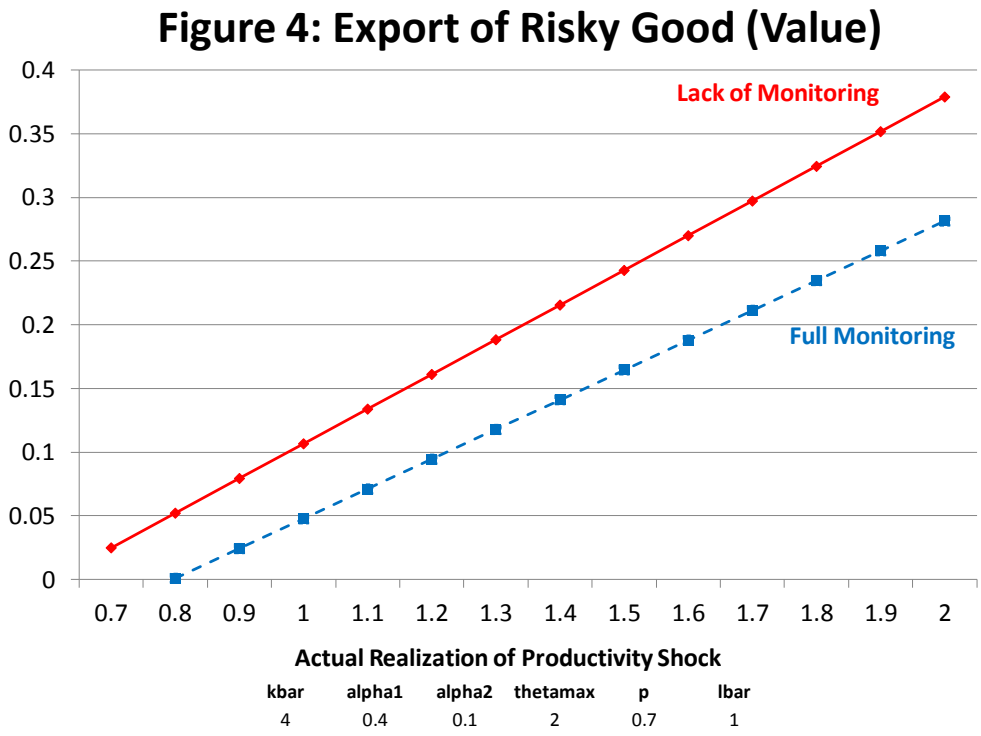


kbar	alpha1	alpha2	thetamax	p	lbar
4	0.4	0.1	2	0.7	1

Figure 3: Export of Risky Good (Volume)



kbar	alpha1	alpha2	thetamax	p	lbar
4	0.4	0.1	2	0.7	1



IV. Conclusion

The important element of this model is the risk-shifting behavior of borrowers, which was caused by the lack of monitoring in the borrowing usage. The effects of such behavior in the financial sector is transmitted to the real sector via the surge in the demand to invest in the risky sector that pushes up the price of the risky equity and therefore increase the investment into the risky sector.

The model in this chapter focuses on the results from the inability of the lenders to observe the borrowers' investment decision in the lack of monitoring scenario. In doing so, the full monitoring scenario is used as a benchmark to observe whether asset price overshoots and whether overinvestment in the risky sector occurs. However, it is an extreme case and hardly exists in reality, because the main reason banks are lending is that they still rely on

entrepreneurs' private information about investment. If banks have sufficient information to invest in the safe and the risky assets, they would have invested by themselves and not lend to entrepreneurs. Hence, entrepreneurs could appropriate from banks a certain level of informational rent. On the other hand, if entrepreneurs have sufficient funding, they would not have to borrow from banks in the first place.

Another question which could be raised is that, besides the lack of monitoring, limited liability is another feature of the model that would also contribute to the risk-shifting behavior. This is because the limited liability assumption prevents the banks from seizing anything else other than entrepreneurs' portfolio return, thereby protecting entrepreneurs from further loss when their investment turns sour. This leads to another question: what would happen if entrepreneurs have to put collaterals in order to borrow from banks? In other words, what would happen if the limited liability assumption were relaxed? Depending on their degree of risk aversion and on the size of the collateral, such entrepreneurs would hold less of the risky equities, lowering the degree of asset price overshooting and thus the extent of overinvestment in the risky sector. Nevertheless, the main results following the risk-shifting behavior when entrepreneurs are not monitored would still prevail.

In sum, the combination of the real sector framework and the financial sector framework in this model enables the analysis of the linkage between a country's degree of monitoring on the borrowing usage and the riskiness of exports. It hypothesized that the price of the risky equity, the production in the risky sector, and exports of the risky sector are higher when the borrowers' investment decisions cannot be monitored. An empirical test for this hypothesis is presented in the next chapter.

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CHAPTER 2

Risk-Biased Exports: the Role of Creditors' Protection (An Empirical Test)

I. Introduction

What are the possible ways that the financial sector and the real sector are connected? What could be the effects of the disruption in the financial sector on the real sector?

The previous chapter modeled a channel through which a country's degree of monitoring in the financial sector would influence the real economy. By combining the real sector framework of Helpman and Razin (1978) and the financial sector framework of Allen and Gale (2000), it portrayed that the lack of monitoring on the borrowing usage would encourage risk-shifting behavior, causing overinvestment in the risky production sector that is more susceptible to shocks. As a result, the price of the risky stocks as well as the production and exports of the risky sector will rise. Such higher exports in the risky sector may cause a country to face increased macroeconomic volatility (OECD (2006), Caballero and Cowan (2007), and Koren and Tenreyro (2007)).

This chapter provides an empirical test on whether the low degree of monitoring would gear a country's exports towards risky production sectors.

One of the challenges in conducting this empirical exercise is finding a proxy for the riskiness of a country's exports. Before doing so, it is necessary to identify which production sectors are risky. Koren and Tenreyro (2007) measured the intrinsic volatility of different sectors using the variance of the sectoral value added growth. The riskier sectors are the ones with higher intrinsic volatility. From the method of Koren and Tenreyro (2007), Di Giovanni and Levchenko (2011) developed the measure of a country's export riskiness, which is called the

risk content of exports, by multiplying the square of each sector's share of exports to the intrinsic sectoral volatility. The risk content of exports can thus be viewed as the variance of export patterns. A country's exports riskiness would rise when its export pattern is tilted towards sectors with high intrinsic volatility.

Another challenge of this empirical test is measuring how well the borrowing usage is monitored. The previous chapter modeled the degree of monitoring in the following way. If the borrowing usage is poorly monitored, lenders may not be fully repaid. In contrast, if the borrowing usage is fully monitored, lenders are always repaid fully. Thus, an empirical proxy should be able to capture whether it is easy for lenders to be repaid. La Porta, Lopes-Silanes, Shleifer, and Vishny (1996) (henceforth LLSV (1996)) developed a de jure measure called the creditor rights index (CRI), which accesses the four aspects of creditors' legal rights against defaulting debtors. Such legal rights would become stronger when there are restrictions on the borrowers' filing for reorganization, when secured creditors can possess their security right after the approval of the reorganization petition, when secured creditors can first gain the proceeds from a bankrupt debtor, and when debtor can no longer administer their properties pending the resolution of the reorganization. Djankov et al (2007) extended the data of LLSV 1996 to cover from 49 countries to 129 countries from 1978 to 2004. This chapter will use the CRI data from Djankov et al (2007) as a proxy for the degree of monitoring. Not only is this measure in line with the previous chapter's theoretical set-up, but the extended data set would also allow for time series variation[5].

Many studies have explored the importance of creditors' rights in various aspects. For instance, LLSV (1997) examined the impacts of creditors' power on the size and the depth of the

[5] Other variables, such as contract enforcement, do not have long data series.

bond markets and the stock markets. Djankov et al (2007) investigated how creditors' power affects the extent of credits to the economy. Acharya, Amihud, and Litov (2011) studied the relationship between creditors' rights and corporate risk-taking behavior and corporate leverage. Hale, Razin, and Tong (2012) provided insights on the effects of creditor rights on stock prices in the face of liquidity crises. Nevertheless, none of these literature have linked the riskiness of exports with creditors' rights.

An empirical test in this chapter analyzed the data of the risk content of exports and creditor rights index from developed and developing economies over the period of 1978-2004. Using fixed effects regressions, the results revealed that countries with poorer creditor rights are the ones with higher risk content of exports. This finding remained robust even after excluding the most volatile production sectors from the analysis. And when separately examining the effects of the four different components of creditor rights index, it is shown that the effects of creditor rights arises from the restrictions on the borrowers' filing for reorganization.

The remainder of this chapter is organized as follows. Sections II and III explain more about the dependent variable and the explanatory variables, respectively. Section IV reveals the results, and Section V concludes.

II. Dependent Variable

A dependent variable for this empirical exercise is Di Giovanni and Levchenko (2011)'s risk content of exports, which aims to capture export volatility. The rationale behind the construction of this index is that a country's export volatility can be broken down into two parts, the intrinsic volatility of each sector and a country's share of exports in each sector.

This chapter follows the steps in Di Giovanni and Levchenko (2011) to obtain the data of the sectoral value added growth. The value added data of the 28 manufacturing sectors come from the UNIDO Industrial Statistics Database, which reports the data using the 3-digit ISIC Revision 3 classification. In addition, the value added in agriculture (short for Agriculture, Hunting, Forestry and Fishing) and mining (short for Mining and Quarrying) sectors come from the United Nations National Accounts Official Country Data. Hence there are a total of 30 production sectors. The value added data were originally reported in current U.S. dollars, and they are converted into constant international dollars using the Penn World Tables.

The data of the countries' sectoral exports to the rest of the world come from the UN Comtrade Database, which reports the data according to the 4-digit SITC Revision 2 classification. Hence, the sectoral exports data are converted into the 3-digit ISIC Revision 3 classification using the tables provided in M. Affendy, Yee, and Satoru (2010).

First, the sectoral intrinsic volatility is calculated using the method similar to Koren and Tenreyro (2007). Define y_{ict} as the value added growth, which reflects innovations to the value added, in country *c*, sector *i*, and time *t*. To control for the cross-country long-run differences in the value added growth, the series y_{ict} is subtracted by the mean growth rate for each country and sector over the entire time period. The demeaned value added growth is denoted as $\widetilde{y_{ict}}$, and it can be seen as the sector-specific shock for each country and each year.

$$\widetilde{y_{ict}} = y_{ict} - \frac{1}{T}\sum_{t=1}^{T} y_{ict}$$

Then a global shock for sector i and time t, denoted as Y_{it}, is calculated by averaging the series $\widetilde{y_{ict}}$ across countries for each sector and each year.

$$Y_{it} = \frac{1}{C}\sum_{c=1}^{C} \widetilde{y_{ict}}$$

After obtaining the global sector-specific shock Y_{it}, the sample variance of this series is computed. Such variance is used as a measure of the sectoral intrinsic volatility.

$$\sigma_i^2 = \frac{1}{T-1}\sum_{t=1}^{T}(Y_{it} - \overline{Y_i})^2$$

The sample covariance between Y_{it} and Y_{jt}, which captures how shocks of different sectors covary, is also computed for each pair of different sectors *i* and *j*.

$$\sigma_{ij} = \frac{1}{T-1}\sum_{t=1}^{T}(Y_{it} - \overline{Y_i})(Y_{jt} - \overline{Y_j})$$

Repeating this procedure for all the 30 production sectors gives the 30x30 variance-covariance matrix, which will be denoted as $\sum$. By construction, $\sum$ is country and time invariant.

Table 4 summarized the summary statistics of the growth in value added for each industry. The square of the reported standard deviation is equal to the diagonal of $\sum$. Miscellaneous petroleum and coal products industry is the one with the highest variance, followed by other manufactured products. The industries with the lowest variance are mining and agriculture[6].

Afterwards, for different countries and years, each of the thirty industry's share of export to total exports, a_{ict}^X, is constructed and regrouped to form a 30x1 vector denoted as a_{ct}^X. Finally, the risk content of export index is calculated as follow:

$$Riskcontent_{c,t} = a_{ct}^X \sum a_{ct}^X$$

This is a composite index for each country and each year. The higher magnitude of the risk content of exports indicates that a country has higher exports in sectors with higher volatility in

[6] This finding still holds after excluding outliers in the miscellaneous petroleum and coal products sector.

production. In addition, since the sectoral intrinsic volatility is country and time invariant, the cross-country differences of this index comes solely from the difference in export patterns.

III. Explanatory Variables

The explanatory variable of interest is an empirical proxy that captures the degree of enforcing debt repayment, which would reflect the degree of monitoring the borrowing usage. The creditor rights index (CRI) will be used as such proxy, because it measures whether creditors can more easily force repayment, grab collateral, or gain control of the debtors' assets.

The CRI was first proposed by LLSV (1996) and later extended by Djankov et al (2007). It was constructed during January of every year. First, the bankruptcy and bankruptcy-related laws were reviewed to identify major reforms and assess the impacts of such reforms on the CRI. Then the local bankruptcy lawyers were surveyed to confirm or amend the timing of reforms and their impacts.

The index takes the values from 0 to 4. One additional point is added if a country's law and regulations contains each of these four aspects of creditors' power in bankruptcy.

a. Restrictions on reorganization filing

In some countries, debtors can unilaterally seek protection from creditors by filing for reorganization without creditor consent. If this is the case, creditors can, at best, get their money or collateral with a delay. Thus, restrictions on reorganization filing, such as the creditor consent or minimum dividends, would make it more difficult for debtors to escape creditors' demands.

b. The lack of automatic stay or asset freeze

Automatic stay prevents creditors from repossessing the loan collateral, thereby protecting debtors. If there is no automatic stay, creditors can pull collateral even before the completion of reorganization.

c. Priority for secured creditors to gain before other entities the proceeds from asset disposition

In countries where creditors were repaid after other entities, they could be left with no assets to back up their claims. An example would be Mexico, where secured creditors were repaid after various social constituencies. Providing such priority would strengthen creditor rights.

d. Prohibition of management to administer the properties pending the resolution of reorganization

In some countries, such as Malaysia, management (debtor) is replaced by a party appointed by the court or creditors. This threat of dismissal may improve creditors' power.

The higher the index, the stronger the protection of creditors.

Since 1978, there have been a total of 162 reforms across 99 countries, but only 32 reforms in 25 countries affect the CRI. The years and countries in which those reforms took place and their impacts on the CRI are summarized in Table 2.5.

Table 2.6 shows the CRI and its components of various countries in 2003. There is a mix of advanced economies and emerging markets and developing countries that obtain each of the different scores from 0 to 4. Very similar pattern also appear on other years because of the infrequent time series variation. LLSV (1996) as well as Djankov et al. (2007) documented that the CRI scores varies systematically across legal origins. Economies that are of English common law legal origin, such as the United Kingdom and Hong Kong, tend to have the highest CRI. As for countries that are of German civil law legal origin (such as Germany, Japan, South

Korea, and Switzerland) and of Nordic legal origin, their CRI tend to be intermediate. Finally, CRI is the lowest among French civil law countries.

The control variables include the share of a country's share of inward foreign direct investment (FDI) to the world's total FDI, the per capita GDP in constant dollar, a measure of trade openness, and a measure of financial openness. A country's share of inward FDI to the world's total FDI captures the global allocation of investment through foreign direct investment, which could affect a country's overall production capacity. Similar to Di Giovanni and Levchenko, the per capita GDP and its square divided by 100 are included to control for the non-linear effect of country's size. The trade openness measure, which is the natural log of total exports plus total imports to GDP, captures a country's degree of trade integration, which could potentially affect its production specialization pattern. While Di Giovanni and Levchenko used a de facto measure of financial openness (total external assets plus total external liabilities divided by GDP), this paper used Chinn-Ito's de jure financial openness index instead since the share of inward FDI is already included in a regression. The Chinn-Ito financial openness index is calculated based on indicators for different aspects of financial openness published in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). The index is the first standardized principal component of these four variables:

a. Variable indicating the presence of multiple exchange rate
b. Variable indicating restrictions on current account transactions
c. 5-year average of variable indicating restrictions on capital account transactions
d. Variable indicating the requirement of the surrender of export proceeds

The index has a mean of zero, and the higher value of the index indicates the higher degree of financial openness.

IV. Results

A reduced form regression to test the effect of the credit market quality on the riskiness of exports is as follow:

$$Riskcontent_{c,t} = \alpha + \beta CRI_{c,t} + \delta X'_{c,t} + \eta_c + \gamma_t + \varepsilon_{c,t}$$

where $Riskcontent_{c,t}$ is the risk content of exports index, $CRI_{c,t}$ is the creditor rights index, and $X'_{c,t}$ are the control variables mentioned above. According to the predictions from the model, the lower quality of a country's credit market would lead to the higher riskiness in exports, so the coefficient in front of $CRI_{c,t}$ should be negative. The country-specific effects and time-specific effects are denoted by η_c and γ_t, respectively. The sample period is from 1978 to 2004.

Table 2.7 reveals the results of the above fixed effects regression. The first column includes the GDP per capita, the re-scaled square of GDP per capita, and the de jure financial openness measure as controls. The second column also includes, in addition to the three controls, the share of inward FDI. The third column includes the trade openness measure instead of the share of inward FDI, and the fourth column includes all the control variables. All of these four columns point out a significant negative relationship between the creditor rights index and the risk content of exports, suggesting that countries with lower degree of creditor rights have riskier exports.

Another noteworthy point is that the trade openness measure does not appear to be significant in determining a country's riskiness in exports. This is consistent with the finding of Di Giovanni and Levchenko. However, in contrast to Di Giovanni and Levchenko, the de jure financial openness measure has a significant positive effect on a country's risk content in exports, meaning that higher financial openness is associated with higher exports in risky sectors.

A robustness test is conducted to examine if the regression results are driven by the high volatility of petroleum-related industries. Table 2.8 revisited the previous regressions. However, the dependent variable is different. This time, miscellaneous petroleum and coal products industry and petroleum refineries industry are removed from the calculation of the risk content of exports. The results of this test are in line with the main regressions.

In addition, Table 2.9 investigated which components of the creditor rights index are responsible for varying the riskiness of exports. The regressions use the same set of control variables as the main regressions, but the CRI is replaced by all of its components[7]. It is shown that the restrictions on reorganization filing matters a great deal. However, the lack of automatic stay on assets, the priority of secured creditors, and the removal of management after bankruptcy are not particularly important. This evidence suggests that debtors' ability to escape creditors' demands supports riskier exports. In other words, if debtors can seek protection from creditors by filing for reorganization without restrictions, such as the need for creditor consent, creditors may, at best, be repaid with a delay. Thus, it is easier for debtors to get away without repaying their loans. This could encourage more risk-shifting behavior and gear their investments towards the risky sectors, thereby increasing the production and exports in the risky sectors.

V. Conclusion

In sum, this paper series provides a possible cause behind the overshooting in asset price and traces some implications of a disruption in the financial sector to the real sector. A two-period, two-sectors, small open economy model predicts that the lack of monitoring of

[7] The sample period for this analysis is from 1978 to 2003, because there is a considerable amount of missing data on the CRI components in 2004.

borrowing usage would lead to risk-shifting behavior in the financial market and thus over-investment in a risky sector that is more subject to production volatility. This simultaneously causes the risky sector's stock price as well as its production and exports to be higher compared to the scenario when borrowing usage is well-monitored. The result of an empirical exercise is also in line with a model's hypothesis that countries with poorer quality credit markets are the ones with higher exports in sectors with greater volatility in production.

As Caballero and Cowan (2007) pinpointed, countries that specialize in risky production sectors after trade liberalization are more likely to face higher macroeconomic volatility. Therefore, the results of this paper could hint a linkage between financial sector policy stance and macroeconomic conditions, suggesting that countries with weak monitoring system in financial sector may experience more volatile output. Nevertheless, such linkage needed to be more closely investigated in further studies.

VI. APPENDIX A.

Table 2.1: Variables and Data Sources

Variable	Data Source
Value added by sectors	UNIDO Industrial Statistics Database, UN National Accounts Official Country Data
Exports by sector	UN Comtrade Database
Creditor rights index	Djankov et al. (2007)
Share of inward FDI	Lane and Milesi-Ferretti (2006)
GDP per capita in constant dollar	IFS
Trade openness	IFS
Chinn-Ito financial openness index	Chinn and Ito (2008)

Table 2.2: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Risk content of exports index	1423	0.1837	0.7893	0.00002	12.95
Creditor rights index	1415	1.9025	1.1581	0	4
Share of inward FDI	1143	0.0236	0.0410	0	0.284
GDP per capita in constant dollar	1148	10207.46	9654.44	191.10	39004.86
Trade openness	1117	4.0334	0.5218	2.446	5.930
Chinn-Ito financial openness index	1122	0.5064	1.5806	-1.831	2.500

Table 2.3: Pair-Wise Correlations

Variable	1	2	3	4	5	6
1. Risk content of exports index	1					
2. Creditor rights index	0.0301	1				
3. Share of inward FDI	-0.0941	0.097	1			
4. GDP per capita in constant dollar	-0.1113	0.2849	0.3639	1		
5. Trade openness	0.0479	0.1724	-0.0552	0.1159	1	
6. Chinn-Ito financial openness index	-0.0482	0.3124	0.3226	0.6357	0.1672	1

Table 2.4: Sector Summary Statistics

Sector Name	Growth of Value Added	
	Mean	Std. Dev.
Agriculture	0.0023	0.1455
Beverages	0.0395	0.5111
Fabricated metal products	0.0416	0.4450
Food products	0.0440	0.4069
Footwear, except rubber or plastic	-0.0129	0.8806
Furniture, except metal	0.3375	5.4811
Glass and products	0.0647	0.4608
Industrial chemicals	0.1565	0.9894
Iron and steel	0.2105	1.1886
Leather products	-0.0106	0.6530
Machinery, electric	0.0151	2.6286
Machinery, except electrical	0.0431	0.8157
Mining and quarrying	-0.0022	0.1217
Misc. petroleum and coal products	38.6708	499.9505
Non-ferrous metals	0.3031	3.6214
Other non-metallic mineral products	0.0464	0.4376
Other chemicals	-0.0014	0.3313
Other manufactured products	1.5578	28.6340
Paper and products	0.0562	0.3707
Petroleum refineries	-0.0068	1.4631
Plastic products	0.0628	0.2887
Pottery, china, earthenware	0.1240	2.5297
Professional and scientific equipment	0.4467	4.0947
Printing and publishing	0.0456	0.3301
Rubber products	0.0656	0.5740
Textiles	-0.0169	0.2509
Tobacco	0.1087	2.2677
Transport equipment	0.0760	0.6354
Wearing apparel, except footwear	0.1526	2.9813
Wood products, except furniture	0.0629	0.3687

Table 2.5: Creditor Rights Reforms

Country	Year of Reform	Change in CRI	Reorganization Restrictions	No Automatic Stay	Priority to Secured Creditors	Management do not Stay
Austria	1982	-1				-1
Denmark	1984	1				1
United Kingdom	1985	1				1
Ireland	1990	-1	-1			
Canada	1992	-1				-1
Finland	1993	-2	-1			-1
India	1993	-1		-1		
Russian Federation	1994	1				1
Romania	1994	1		1		
Israel	1995	-1	-1			
Sweden	1995	-1				-1
Lithuania	1995	1	1			
Armenia	1996	-1		-1		
Azerbaijan	1997	1				1
Kazakhstan	1997	1				1
Mongolia	1997	1				1
Niger	1998	-2	-1		-1	
Indonesia	1998	-1		-1		
Russian Federation	1998	-1				-1
Kazakhstan	1998	1	1			
Lithuania	1998	1			1	
Thailand	1999	-1		-1		
Ukraine	1999	-1		-1		
Japan	2000	-1		-1		
Malawi	2000	-1	-1			
Bulgaria	2000	1	1			
Kazakhstan	2001	-1			-1	
Uruguay	2001	1		1		
Japan	2003	1		1		
Russian Federation	2002	1				1
Romania	2003	1		1		
Spain	2004	1			1	

Source: Djankov et al (2007)

Table 2.6: Creditor Rights Index and Its Components in 2003

country	CRI	CRI Components			
		Reorganization Restrictions	No Automatic Stay	Priority to Secured Creditors	Management do not Stay
Benin	0	0	0	0	0
Burkina Faso	0	0	0	0	0
Cameroon	0	0	0	0	0
Central African Republic	0	0	0	0	0
Chad	0	0	0	0	0
Colombia	0	0	0	0	0
Congo, Rep.	0	0	0	0	0
Cote d'Ivoire	0	0	0	0	0
Ecuador	0	0	0	0	0
France	0	0	0	0	0
Guinea	0	0	0	0	0
Lao PDR	0	0	0	0	0
Mali	0	0	0	0	0
Mexico	0	0	0	0	0
Niger	0	0	0	0	0
Oman	0	0	0	0	0
Peru	0	0	0	0	0
Senegal	0	0	0	0	0
Togo	0	0	0	0	0
Tunisia	0	0	0	0	0
Yemen, Rep.	0	0	0	0	0
Algeria	1	0	0	0	1
Argentina	1	0	0	1	0
Brazil	1	0	1	0	0
Burundi	1	0	0	0	1
Canada	1	0	0	1	0
Congo, Dem. Rep.	1	0	0	0	1
Costa Rica	1	0	0	1	0
Finland	1	0	0	1	0

Table 2.6: Creditor Rights Index and Its Components in 2003 (Continued)

country	CRI	CRI Components			
		Reorganization Restrictions	No Automatic Stay	Priority to Secured Creditors	Management do not Stay
Ghana	1	0	0	0	1
Greece	1	1	0	0	0
Guatemala	1	0	0	1	0
Hungary	1	1	0	0	0
Ireland	1	0	0	1	0
Jordan	1	0	0	0	1
Lesotho	1	0	0	1	0
Mauritania	1	0	1	0	0
Morocco	1	0	0	0	1
Pakistan	1	0	0	1	0
Papua New Guinea	1	0	0	1	0
Paraguay	1	0	0	1	0
Philippines	1	0	0	1	0
Poland	1	0	0	0	1
Portugal	1	0	0	1	0
Puerto Rico	1	0	0	1	0
Rwanda	1	1	0	0	0
Sweden	1	0	0	1	0
Switzerland	1	0	0	1	0
United States	1	0	0	1	0
Vietnam	1	0	0	1	0
Zambia	1	0	0	0	1
Armenia	2	0	0	1	1
Bangladesh	2	0	0	1	1
Belarus	2	1	0	0	1
Belgium	2	0	0	1	1
Bolivia	2	1	0	1	0
Bulgaria	2	0	0	1	1
Cambodia	2	1	0	1	0

Table 2.6: Creditor Rights Index and Its Components in 2003 (Continued)

country	CRI	CRI Components			
		Reorganization Restrictions	No Automatic Stay	Priority to Secured Creditors	Management do not Stay
Chile	2	0	1	1	0
China	2	1	0	1	0
Dominican Republic	2	0	1	1	0
Egypt, Arab Rep.	2	1	0	0	1
Georgia	2	0	0	1	1
Haiti	2	0	1	1	0
Honduras	2	1	0	0	1
India	2	1	0	1	0
Indonesia	2	0	0	1	1
Iran	2	0	0	1	1
Italy	2	1	0	0	1
Jamaica	2	0	1	1	0
Japan	2	0	0	1	1
Kazakhstan	2	1	0	0	1
Lithuania	2	1	0	1	0
Madagascar	2	0	0	1	1
Malawi	2	0	1	0	1
Moldova	2	0	1	1	0
Mongolia	2	0	0	1	1
Mozambique	2	0	1	1	0
Namibia	2	0	0	1	1
Nepal	2	1	1	0	0
Norway	2	1	0	1	0
Romania	2	0	1	1	0
Russian Federation	2	1	0	0	1
Slovak Republic	2	0	1	1	0
Spain	2	0	1	0	1
Sri Lanka	2	1	0	0	1
Taiwan, China	2	0	0	1	1

Table 2.6: Creditor Rights Index and Its Components in 2003 (Continued)

country	CRI	CRI Components			
		Reorganization Restrictions	No Automatic Stay	Priority to Secured Creditors	Management do not Stay
Tanzania	2	0	1	0	1
Thailand	2	0	0	1	1
Turkey	2	1	1	0	0
Uganda	2	0	1	0	1
Ukraine	2	0	0	1	1
United Arab Emirates	2	1	1	0	0
Uzbekistan	2	1	0	1	0
Albania	3	0	1	1	1
Angola	3	1	1	1	0
Australia	3	0	1	1	1
Austria	3	0	1	1	0
Azerbaijan	3	0	1	1	1
Bosnia and Herzegovina	3	0	1	1	1
Botswana	3	0	1	1	1
Croatia	3	0	1	1	1
Czech Republic	3	0	1	1	1
Denmark	3	0	1	1	1
Uzbekistan	2	1	0	1	0
Albania	3	0	1	1	1
Angola	3	1	1	1	0
Australia	3	0	1	1	1
Austria	3	0	1	1	0
Azerbaijan	3	0	1	1	1
Bosnia and Herzegovina	3	0	1	1	1
Botswana	3	0	1	1	1
Croatia	3	0	1	1	1
Czech Republic	3	0	1	1	1
Denmark	3	0	1	1	1
El Salvador	3	1	1	1	0

Table 2.6: Creditor Rights Index and Its Components in 2003 (Continued)

country	CRI	CRI Components			
		Reorganization Restrictions	No Automatic Stay	Priority to Secured Creditors	Management do not Stay
Ethiopia	3	1	0	1	1
Germany	3	0	1	1	1
Israel	3	0	1	1	1
Korea, Rep.	3	0	1	1	1
Kuwait	3	1	1	1	0
Kyrgyz Republic	3	0	1	1	1
Latvia	3	1	0	1	1
Macedonia	3	0	1	1	1
Malaysia	3	1	1	1	0
Netherlands	3	0	1	1	1
Saudi Arabia	3	1	1	1	0
Singapore	3	0	1	1	1
Slovenia	3	0	1	1	1
South Africa	3	1	0	1	1
Syrian Arab Republic	3	1	1	0	1
Uruguay	3	1	1	1	0
Venezuela, RB	3	0	1	1	1
Hong Kong	4	1	1	1	1
Kenya	4	1	1	1	1
Lebanon	4	1	1	1	1
New Zealand	4	1	1	1	1
Nicaragua	4	1	1	1	1
Nigeria	4	1	1	1	1
Panama	4	1	1	1	1
United Kingdom	4	1	1	1	1
Zimbabwe	4	1	1	1	1

Table 2.7: Regressions of Creditors' Protection on the Riskiness of Exports

Dependent Variable: Risk Content of Exports Index

Explanatory Variables	(1)	(2)	(3)	(4)
Creditor rights index	-0.12*	-0.12*	-0.13**	-0.13**
	(0.06)	*(0.06)*	*(0.07)*	*(0.07)*
Constant dollar GDP per capita	-0.31	-0.31	-0.46	-0.47
	(0.30)	*(0.30)*	*(0.33)*	*(0.33)*
(GDP per capita)^2/100	3.63	3.60	6.27	6.30
	(5.85)	*(5.86)*	*(6.36)*	*(6.37)*
Financial openness index	0.10***	0.10***	0.11***	0.11***
	(0.03)	*(0.03)*	*(0.03)*	*(0.03)*
Share of inward FDI		-0.31		-0.50
		(1.12)		*(1.16)*
Trade openness			0.002	-0.003
			(0.15)	*(0.15)*
No. of Observations	1120	1119	1090	1089
No. of Countries	61	61	60	60
R-squared	0.0102	0.0109	0.0124	0.0132

Table 2.8: Regressions of Creditors' Protection on the Riskiness of Exports-Excluding Petroleum-Related Industries

Dependent Variable: Risk Content of Exports Index (without petroleum-related industries)

Explanatory Variables	(1)	(2)	(3)	(4)
Creditor rights index	-0.07*	-0.07*	-0.08*	-0.08*
	(0.04)	*(0.04)*	*(0.04)*	*(0.04)*
Constant dollar GDP per capita	-0.14	-0.15	-0.22	-0.23
	(0.19)	*(0.19)*	*(0.21)*	*(0.21)*
(GDP per capita)^2/100	0.96	0.94	1.63	1.66
	(3.77)	*(3.78)*	*(4.10)*	*(4.11)*
Financial openness index	0.09***	0.09***	0.10***	0.10***
	(0.02)	*(0.02)*	*(0.02)*	*(0.02)*
Share of inward FDI		-0.30		-0.45
		(0.72)		*(0.75)*
Trade openness			-0.14	-0.14
			(0.10)	*(0.10)*
No. of Observations	1120	1119	1090	1089
No. of Countries	61	61	60	60
R-squared	0.0009	0.0014	0.0002	0.0004

Table 2.9: Regressions of Creditors' Protection Components on the Riskiness of Exports

Dependent Variable: Risk Content of Exports Index

Explanatory Variables	1	2	3	4
Creditor rights index components				
Reorganization Restrictions	-0.20*	-0.23*	-0.25*	-0.26*
	(0.11)	*(0.14)*	*(0.14)*	*(0.14)*
No Automatic Stay	-0.17	-0.17	-0.18	-0.18
	(0.10)	*(0.12)*	*(0.13)*	*(0.13)*
Priority to Secured Creditors	0.05	0.03	0.02	0.01
	(0.33)	*(0.40)*	*(0.40)*	*(0.40)*
Management do not Stay	0.01	-0.002	-0.02	-0.01
	(0.09)	*(0.11)*	*(0.11)*	*(0.11)*
Constant dollar GDP per capita	-0.30	-0.41	-0.56*	-0.58*
	(0.24)	*(0.28)*	*(0.32)*	*(0.32)*
(GDP per capita)^2/100	4.00	6.47	8.42	8.62
	(4.59)	*(5.53)*	*(6.00)*	*(6.01)*
Financial openness index	0.09***	0.09***	0.10***	0.10***
	(0.02)	*(0.02)*	*(0.02)*	*(0.03)*
Share of inward FDI		-0.61		-0.81
		(1.00)		*(1.02)*
Trade openness			-0.09	-0.09
			(0.14)	*(0.14)*
No. of Observations	1053	1053	1029	1028
No. of Countries	60	60	59	59
R-squared	0.0047	0.0065	0.007	0.0082

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CHAPTER 3

Equity Prices and Equity Flows: Testing Theory of the Information-Efficiency Tradeoff

I. Introduction

Recently, international capital markets globalization has ushered large flows of international equity, which has substantially affected the cost of capital, the capital market volatility, and economic growth[8]. These flows take two major forms: Foreign Direct Investments (FDI) and Foreign Equity Investments (FPI). FDI involve a control over a firm's management, whereas FPI do not involve such control. These two types of flows have different implications on the stability of the capital markets of the host countries and of other countries. While FDI is more stable, FPI is usually liquidated during financial crises (Frankel and Rose (1996), Lipsey (2001), and Sarno and Taylor (1999)). Hence, it is necessary to take into account the composition of international equity flows in order to examine the cost and benefits of the liberalization of international equity markets.

Although the importance of the distinction between FDI and FPI is well known, the determinants of the choice between them have not been widely explored. In the past, multinationals engaged in FDI, collective investment funds engaged in FPI. Thus, investors' choice between multinationals and investment funds would influence the composition of FDI and FPI. But investment funds have recently become more active in FDI investment than ever. As indicated in the 2006 World Investment Report, about half of the $261 billion raised by these funds were used towards FDI. This means that the choice between FDI and FPI has become

[8] See, for instance, Bekaert and Harvey (2000), Errunza and Miller (2000), Henry (2000), Chari and Henry (2004), and Bekaert, Harvey, and Lundblad (2005). Stulz (2005) provided a review about the development of financial liberalization and its limitations.

more direct. These funds have undergone significant expansion due to the low interest rate, high investors' liquidity, and the satisfactory performance of private equity funds. Nevertheless, global financial crises and the credit crunch that followed have made it more difficult for private equity funds to conduct FDI investments.

Previous literature (Froot and Stein (1991), Klein, Peek, and Rosengren (2002), Rossi and Volpin (2004), Aguiar and Gopinath (2005), Albuquerque, Loayza, and Serven (2005), and Baker, Foley, and Wurgler (2009)) studied the determinants of FDI (including cross-border M&As) and emphasized factors such as wealth, credit constraints, governance, mispricing, and fire sales. Other papers examined the determinants of FPI (such as Griffin, Nardari, and Stulz (2004), Gelos and Wei (2005), Ferreira and Matos (2008), and Leuz, Lins, and Warnock (2009)). However, none of them investigated the impact of the liquidity risk or studied the determinants of the source countries' FDI and FPI composition.

Following the study of Goldstein, Razin, and Tong (2007), this chapter tests three hypotheses concerning the composition of foreign equity investment in the presence of liquidity risk. First, the FDI-to-FPI price differential is negatively related to liquidity risk (the "Price Discount Hypothesis"). The idea is that direct investments would incur a price discount because market participants do not know whether the FDI investor liquidates a firm because of an idiosyncratic liquidity shock, or because, as an informed investor, the firm is hit by a productivity shock. Second, the FDI-to-FPI composition would skew towards FPI if investors expect to experience liquidity shortage in the future (the ""Equity-Composition Hypothesis"). Since direct investments are more costly to liquidate, due to the price discount, investors would be inclined to hold less FDI if they expect more severe liquidity shock. The third hypothesis, on the other hand, states that the FDI-to-FPI composition would skew towards FDI if the past FDI-

to-FPI stocks were larger (the "Strategic Complementarity Hypothesis"). If the initial proportion of direct investments is higher, it is more likely that a direct investment is sold due to liquidity needs. This improves the price of the prematurely sold direct investment, creating an incentive for more investors to choose FDI rather than FPI.

In conducting an empirical test, the nationwide sales of external assets is used as a proxy for liquidity problems, and the measures of FDI and FPI are based on the source countries' stock of external assets compiled by Lane and Milesi-Ferretti (2007). Using a sample of 65 countries between 1970 and 2004, this chapter examined the effects of liquidity crisis on the relative price of FDI and FPI as well as the outward FPI to FDI ratio.

The rest of this chapter is organized as follows. Section II explains the adverse selection theory of a choice between FPI and FDI. Section III states the main hypotheses that would be empirically tested. Section IV describes the data. Section V describes the measures of liquidity risk. Section VI presents the econometric model and its different specifications. Sections VII and VIII reveal the results and some robustness tests. Finally, Section IX concludes.

II. Adverse-Selection Theory

The theory of an investor's choice between FPI and FDI is based on an information-efficiency trade-off between the two. On the one hand, direct investors observe the information about the true productivity of the investment and have control over the management, while portfolio investors could not do so. As a result, an FDI would yield a higher expected payoff compared to an FPI if the investment is held until maturity. On the other hand, the asymmetry of information about the investment productivity causes FDI to be relatively more difficult to sell before they mature. In other words, when an FDI is sold, the market does not know whether it is

sold because of an investor's need of liquidity or because of the low productivity of the investment. Hence, the price of a direct investment would suffer an informational discount, and the magnitude of the discount relies on the market's perception about the probability of a liquidity shock. Such problem would not arise in the case of an FPI.

Theoretical prediction states that the composition of foreign equity investment would be tilted towards FPI and away from FDI if investors expect to face aggregate liquidity shock. This is because the liquidity problem would cause them to sell their assets, and it is more costly to liquidate direct investments. This prediction is independent of the source of illiquidity.
The illiquidity situation was derived endogenously, as a result of asymmetric information, in Goldstein and Razin (2006) and Kirabaeva (2009). The important element of this method is that foreign direct investors can obtain inside information about the investment fundamentals because of their ownership of the firms, which gives FDI an advantage over FPI in terms of managing the investment. But when investors need to sell their investment due to liquidity shock, FDI would face a "lemons" problem and must be sold at a discount. Furthermore, investors' idiosyncratic liquidity shocks are triggered by aggregate liquidity shock. When that happens, investors would then be forced to prematurely sell their investments. However, there are still some investors who are less exposed to the liquidity shock. As a result, once liquidity shock strikes, some investors must sell their direct investments at a discounted price because the buyers do not know if they sell because they truly need liquidity or because of the adverse information.

An equilibrium characterization is that the current FDI-FPI composition is dependent on the past composition. In a pooled equilibrium, direct investors are heterogeneous in terms of their idiosyncratic future liquidity needs. In this case, investors with low liquidity needs would create negative externalities on those with high liquidity needs. The market would estimate the

liquidity risk as an average between the high and the low probabilities of the liquidity shocks. If an investor with high liquidity need sells his investment prematurely, the market would perceive that such sale has to with joint occurrences of some idiosyncratic low productivity liquidity realizations. Because of the information asymmetry, common knowledge about the distribution of idiosyncratic productivity and liquidity shocks could only help the market to evaluate the liquidated assets imperfectly. Thus, FDI are sold at a discount.

If investors with high liquidity need could distinguish themselves from those with low-liquidity needs, the former would be able to sell their assets at a better price. However, this is not possible in the pooling equilibrium. This means that the high liquidity need investors would generate a positive information-externality over low liquidity need investors among direct investors. If the proportion of investors with high liquidity need increases, it is more likely that the prematurely sold FDI in the market would come from those who really need liquidity. This would mitigate the price discount and encourage investors to choose to become direct investors rather than FPI investors. Pooling equilibrium is thus characterized by strategic complementarity. A dynamic implication is that the larger share of FDI flows in the past and in the present would lead to the larger share of FDI flows in the future.

III. Testable Hypotheses

The predictions from the theory described in the previous section lead to the three hypotheses, which will be empirically tested.

a. "Price Discount Hypothesis" – the ratio of FDI price to FPI price is negatively affected by liquidity risk. The idea is that direct investments would incur a price discount because market participants do not know whether the FDI investor liquidates a firm because of an

idiosyncratic liquidity shock, or because, as an informed investor, the firm is hit by a productivity shock.

b. "Equity-Composition Hypothesis" – the FDI-to-FPI composition would skew towards FPI if investors expect to experience liquidity shortage in the future. Since direct investments are more costly to liquidate, due to the price discount, investors would be inclined to hold less FDI if they expect more severe liquidity shock.

c. "Strategic Complementarity Hypothesis" – the FDI-to-FPI composition would skew towards FDI if the past FDI-to-FPI stocks were larger. If the initial proportion of direct investments is higher, it is more likely that a direct investment is sold due to liquidity needs. This improves the price of the prematurely sold direct investment, creating an incentive for more investors to choose FDI rather than FPI.

IV. Data

A key variable of interest is the ratio between the assets that a country holds as FPI and the assets that it holds as FDI. To measure this ratio, we use the recently available data on a country's external assets and liabilities, as compiled by Lane and Milesi-Ferretti (2007). They assembled a comprehensive dataset on the external assets and liabilities of 140 developed and developing countries for the period 1970-2004. They distinguished four types of international assets: foreign direct investment, foreign portfolio (equity) investment, official reserves, and external debt. The convention for distinguishing between direct investment and portfolio

investment is to see whether the ownership of shares of companies is above or below 10%. If it is above the threshold, then it is classified as direct investment[9].

For most countries, Lane and Milesi-Ferretti (2007) used as a benchmark the official International Investment Position (IIP) estimates. However, only very few countries have consistently reported their IIP over the period 1970-2004, and the majority of countries started to report in the early 1990s. For earlier years, they then work backwards with data on capital flows, together with calculations for capital gains and losses, to generate estimates for stock positions. In their estimation, due to cross-country variation in the reliability of the data, they also employ a range of valuation techniques to obtain the most appropriate series for each country. Particularly, they use similar valuation adjustment for FPI and FDI.

The dataset consists of 140 economies from 1970 to 2004, and the stock of international assets and liabilities are divided into four types: foreign direct investment, portfolio equity investment, official reserves, and external debt. The dataset contains more data on developed economies than developing ones due to data availability. The outward FDI and FPI from the source countries are measured using the data of the source countries' stock of FDI assets and equity assets, respectively. The other macroeconomic variables, which will serve as controls in the regressions, are from WDI.

Our sample includes both developed and developing countries as source countries for outward FPI and FDI. New sources of FDI are emerging among developing and transition economies, as multinationals from these economies become major regional - or sometimes even

[9] Arguably, there is the problem of "borderline" cases where it is difficult to classify an investment as FDI or FPI. In countries where FPI is liberalized, a portfolio investor might buy more than 10 percent of the shares of companies without having a "lasting interest" to control the companies. And yet that investor's investment can be classified as FDI. Using the control interest as a dividing line, there are circumstances where FDI can turn into FPI through the dilution of ownership and loss of control. Conversely, FPI can be transformed into FDI, if the investor decides to have a management interest in the companies whose assets he had earlier purchased as FPI.

global - players. It seems that the new global links these multinationals are forging will have far-reaching repercussions in shaping the world economic landscape of the coming decades (UNCTAD: World Investment Report 2006). Table 1 lists the countries covered in the sample from 1985 till 2004, and their mean ratio of FPI to FDI. Table 2 provides summary statistics[10].

A key explanatory variable measures the extent of liquidity problems in the source country. As we explain in the next section, we estimate this variable using data on annual flows in external assets. This data is collected from the IMF's Balance of Payments dataset[11]. Finally, in the following empirical sections, we will also use a few macroeconomic variables as our explanatory variables. These macroeconomic data, such as GDP, current account balance, exchange rates, and trade openness, are collected from the IMF's World Economic Outlook database, which has historical cross-country coverage. Some other variables, such as political risk and opacity, are collected from various datasets and will be described in more details when introduced.

V. Measures of Liquidity Crises

We follow Goldstein, Razin, and Tong (2007) and define a liquidity crisis as an incident of the negative purchase of external assets, which is composed of foreign exchange reserves, direct investments, portfolio investments, and other assets. The rationale is that when a country is in need of liquidity, it would sell off its less liquid assets to get cash or more liquid holdings. Two measures will be used to proxy the liquidity crisis. The first measure is the truncated liquidity crisis severity variable, which is equal to the country's sales of external assets over its

[10] Sample coverage in the following econometric analyses varies a bit, depending on whether countries have data on various explanatory variables. Table 1 is for the sample when countries have data available for the estimations in Table 3.
[11] This data does not account for changes in valuation, and therefore allows us to capture the notion of the quantity of investment liquidations in our model.

total assets in the next period if such sales is positive (if the liquidity crisis in the next period is present) and zero otherwise. This measure will also capture the magnitude of the liquidity crisis. The second measure is the liquidity crisis binary variable, which is equal to one if the purchase of the external assets in the next period becomes negative and zero otherwise.

VI. Estimating the Effect of the Severity of Liquidity Shocks

The crux of our theory is that if a country expects greater liquidity problems in the future it will increase the share of FPI relative to FDI. We use the variable $E_t Severity_{i,t+1}$ to proxy for the severity of expected liquidity shocks, as perceived in period *t*, and investigate how it affects the FPI/FDI ratio for source countries. The severity variable is defined as the negative purchase of external assets divided by the total assets. The variable is set to zero if such purchase take positive values.

The empirical analysis has two stages. First, to estimate the expected severity of liquidity shocks, we run the following regression:

$$Severity_{i,t+1} = \gamma X_{it} + \theta Z_{it} + \xi_{t+1} + \varsigma_i + \eta_{it+1} \quad (1)$$

Then, we use the expected value of $Severity_{i,t+1}$ estimated from (1) as our main explanatory variable for the ratio of FPI to FDI as well as their levels in period *t*.

The vector Z_{it} is motivated by the literature on financial crises (e.g., Frankel and Rose, 1996). It includes source country political risk index, current account surplus over GDP, and a country's external debt over total assets. Political risk index, from the International Country Risk Guide, is based mainly on government stability, socioeconomic conditions, investment profile,

internal conflict, external conflict, corruption, and bureaucracy quality[12]. It has been linked to financial crises in earlier literature, with higher political risk making the economy vulnerable to capital flow reversals (e.g. Gelos and Wei (2005), and Broner, Gelos and Reinhart (2006)). Identifying the system in (1) and the structural equations requires the exclusion restriction to be satisfied. That is, the variables in Z_{it} should have no effect on the price ratio and the value ratio of FDI and FPI except for the indirect effect via the expected liquidity shock. Indeed, our theory does not suggest the inclusion of political risk, current account surplus, and external debt as direct controls in our structural equations, and we are not aware of other models that suggest such a link. In earlier literature, the host country's political risk has been tied to its level of FDI due to confiscation considerations (Albuquerque (2003) and Alfaro, Kalemli-Ozcan and Volosovych (2008)). The link between FDI and these confiscation considerations, however, does not apply to the source country. Another potential concern is that the current account balance may indirectly affect the FPI/FDI composition through affecting the exchange rate, which may then generate some wealth effect and influence FDI and FPI asymmetrically as in Froot and Stein (1991)[13]. To alleviate this concern, we include a control variable for the real exchange rate in our structural equations[14].

[12] See http://www.prsgroup.com/commonhtml/ methods.html\# _International_Country_Risk.}

[13] The Froot and Stein (1991) model operates via a wealth effect in the host country. Because of frictions in control that exist in FDI but not in FPI, wealth is important only for FDI. Thus a rise in host-country wealth, from the appreciation of its real exchange rate, will increase its FDI inflow, while having no impact on its FPI receipts. One could potentially extend their model to source countries with the prediction that real exchange rate appreciation may increase FDI outflow, relative to FPI outflow.

[14] Baker, Foley, and Wurgler (2009) also argue that higher source country's wealth could significantly boost FDI outflow, due to cheap financial capital. They use the market to book ratio in the US stock market as a proxy of cheap capital for US firms. As the data on exchange rate has more country coverage than the market/book ratio, we will then use the real exchange rate also to proxy for the wealth of source country.

1. Estimating the Effect of a Liquidity Threshold

We also employ an alternative model - the threshold model. The idea here is that a liquidity shock has a strong impact on the FPI/FDI composition only after it reaches a certain threshold, and becomes a "liquidity crisis". In this model, we start by estimating the liquidity crisis dummy:

$$I_{i,t}\left(LiquidityCrisis_{i,t+1}\right) = \begin{cases} 1 \; if \; Severity_{i,t+1} > 0 \\ 0 \; if \; Severity_{i,t+1} \leq 0 \end{cases} \quad (2)$$

where $Severity_{i,t+1}$ is a function of independent variables as specified in equation (1).
After estimating the liquidity crisis dummy, we use it as an explanatory variable in the second-stage equations.

2. Estimating the Effects of Liquidity Risk on the FDI to FPI Price Discount

We estimate a composite price for FDI investment by using prices of different components of FDI, the market component and the reinvested earnings component, weighted by their shares to the total FDI flows.

$$PFDI_{i,t} = \omega P_{i,t}^{market} + (1-\omega) P_{i,t}^{earnings} \quad (3)$$

where ω is the share of the market component of FDI over the total FDI inflows, and $(1-\omega)$ represents the share of the reinvested earnings component of FDI. The market component serves as a proxy for M&A FDI, whereas the reinvested earnings component serves as a proxy for greenfield FDI. The data of both the FDI equity inflows and the total FDI inflows are from the UNCTAD WID Country Profile. The stock market index serves as a proxy for price of the

market component of FDI, $P_{i,t}^{market}$. The data of the stock market index of various countries are obtained from the Economist Intelligence Unit database.

The price of the earnings component of FDI, $P_{i,t}^{earnings}$, will be estimated using the following formula of the unit price of investment, which is specified in del Rio (2004).

$$P_{i,t}^{earnings} = pi * [(ci * cgdp)/(ki * rgdpl)] \quad (4)$$

The variable pi is the PPP price level of investment. The variable cgdp is the GDP per capita at world price, and ci is the investment share of cgdp. Similarly, the variable rgdpl is the GDP per capita at constant world price using Laspeyres price index, and ki is the investment share of rgdpl. The term [(ci*cgdp)/(ki*rgdpl)] serves as the implicit deflator of investment (the data of calculating $P_{i,t}^{earnings}$ is from Penn World Table database of the University of Pennsylvania). In the same way as the price of the equity component of FDI, the price of FPI is also estimated by the stock market index.

To test the price discount hypothesis, the reduced form regression for the prices of FPI and FDI is the following:

$$\ln (P^{FDI}/P_{i,t}^{FPI}) = \eta W_{i,t} + \varsigma_0 (LiquidityCrisis_{i,t+1}) + v_{i,t} \quad (5)$$

The term $W_{i,t}$ includes the log of GDP, the log of GDP per capita (constant price), and inflation. The liquidity crisis variable refers to both the severity and the binary measures of liquidity crisis, which will be instrumented on the factors that affect the possibility that the country may experience a liquidity crisis. The excluded instrumental variables include the current account balance to GDP, the government budget balance to GDP, the percentage of short-term debt, and the measures of political and financial risks from International Country Risk Guide (ICRG). The current account balance and the government budget balance indicate the country's need of

external financing, whereas the percentage of short-term debt signals the country's need of liquidity. The political and financial risks are associated with the creditworthiness of a country (Haque et al. (1997)). According to the price discount hypothesis, the coefficient ς_0 should be negative due to the informational discount on the price of FDI.

In addition to the price discount hypothesis, the strategic complementarity hypothesis also predicts that if a country initially has a higher proportion of direct investors, the informational discount on the price of FDI will be lowered and the price of FDI and therefore increase. To test both of these hypotheses, the above equation will be modified as

$$\begin{aligned} \ln\left(P^{FDI}/P_{i,t}^{FPI}\right) = \eta W_{i,t} &+ \varsigma_0(LiquidityCrisis_{i,t+1}) \\ &+ \varsigma_1((FDI^{in}/AllInwardCapital)_{i,t-1} * (LiquidityCrisis_{i,t+1})) \\ &+ \varsigma_2(FDI^{in}/AllInwardCapital)_{i,t-1} + v_{i,t} \end{aligned} \quad (6)$$

The term $(FDI^{in}/AllInwardCapital)_{i,t-1}$ is used as a proxy of the proportion of direct investors (all inward capital includes inward FDI, FPI, debt, and derivatives). Similar to the previous regression, ς_0 should be negative according to the price discount hypothesis. In addition, the coefficient ς_1 should be positive due to the mitigation of the informational discount on the price of FDI as predicted by the strategic complementarity hypothesis.

3. Estimating the Effects of Liquidity Risk on the Composition of Outward FPI to FDI

Reduced form econometric models will be employed to explore whether the hypothesized mechanisms of international capital movements hold in the data. First, this paper will explore the relationship between liquidity crisis and the capital flows out of the source countries. Unlike Goldstein, Razin, and Tong (2007), which regressed the ratio of FPI to FDI outflows on the predicted probability of the liquidity crisis, this paper will regress the FPI to FDI outflows on the

instrumented liquidity crisis measures. The effect of the liquidity crisis on the ratio of FPI to FDI outflows will be investigated using the following set-up:

$$\ln (FPI/FDI)_{\mathrm{i,t}}^{\mathrm{out}} = \alpha X_{i,t} + \beta_0 \left(LiquidityCrisis_{i,t+1}\right) + \gamma year_t + \mu_i + \epsilon_{i,t} \qquad (7)$$

where the liquidity crisis variable will be instrumented as previously described.

The term $LiquidityCrisis_{i,t+1}$ is measured as the negative net annual purchase of external assets - which include FDI, FPI, other investments and foreign reserves - in country *i* in period *t+1*. We normalize these flows by the stock of total external assets of country *i* at time *t*. X_{it} are variables that affect both the liquidity shock and the ratio of FPI to FDI. The term $\gamma year_t$ denotes time fixed effects, μ_i stands for country fixed effects, and $\epsilon_{i,t}$ is the i.i.d. residual. In (7), we take the log of the *FPI/FDI* to reduce the impact of extreme values.

Our selection of control variables X_{it} is motivated by Faria et al. (2007), who examined the determinants of the composition of a country's external liabilities. They considered a set of explanatory variables, including country size, economic development level, trade openness and financial reform. They find that only country size has some explanatory power on the distribution of equity liabilities between direct investment and portfolio equity. As little work has empirically examined the composition of external assets, we use the control variables in Faria et al. (2007) as our starting point. First, we include two variables - the log of the population and the log of GDP per capita in constant US dollars – to capture market size and the level of economic development. We then also include trade openness, as measured by imports plus exports over GDP, to control for the connection between trade and FDI. We further include the lagged real exchange rate to capture the wealth effect on capital flows (see Froot and Stein (1991)). Table 3.2 provides summary statistics of these variables.

We also consider another specification for the FPI/FDI equation, where the lagged FPI/FDI can affect the current FPI/FDI. Hence, we estimate:

$$\ln (FPI/FDI)^{\text{out}}_{\text{i,t}} = \alpha X_{i,t} + \beta_0\left(LiquidityCrisis_{i,t+1}\right) + \rho \ln (FPI/FDI)^{\text{out}}_{\text{i,t}-1} + \gamma year_t + \mu_i + \epsilon_{i,t} \quad (8)$$

There is a complication in estimating equation (8). That is, if $\epsilon_{i,t}$ is not i.i.d but serially-correlated, then $\ln (FPI/FDI)^{\text{out}}_{\text{i,t}-1}$ will be correlated with $\epsilon_{i,t}$ and thus create an endogeneity problem. To correct this problem, we then use the Arellano-Bond dynamic GMM approach to estimate equation (8).

However, if the number of instruments is larger than the number of groups of data in the dynamic panel model with instrumental variables, it is possible that the problem of too many instruments may occur. If it does, the instruments, although each of them are valid, might be collectively invalid in the finite samples because they over fit the endogenous variable and will also weaken the reliability of the Hansen test for instrument validity (Roodman (2008)). Therefore, the number of instruments included in the dynamic panel models may be less than those included in the fixed effects models.

Next, the effects of the liquidity risk as well as the initial proportion of outward direct investment on the compositions of outward FPI to FDI will be explored by the following fixed effects and dynamic panel regressions:

$$\ln (FPI/FDI)^{\text{out}}_{\text{i,t}} = \alpha X_{i,t} + \beta_0\left(LiquidityCrisis_{i,t+1}\right) + \beta_1((FDI^{out}/AllOutwardCapital)_{i,t-1} * (LiquidityCrisis_{i,t+1})) + \beta_2((FDI^{out}/AllOutwardCapital)_{i,t-1} + \gamma year_t + \mu_i + \epsilon_{i,t} \quad (9)$$

$$\ln (FPI/FDI)^{\text{out}}_{\text{i,t}} = \alpha X_{i,t} + \beta_0\left(LiquidityCrisis_{i,t+1}\right)$$

$$+\beta_1((FDI^{out}/AllOutwardCapital)_{i,t-1} * (LiquidityCrisis_{i,t+1}))$$
$$+\beta_2((FDI^{out}/AllOutwardCapital)_{i,t-1} + \rho \ln (FPI/FDI)^{\text{out}}_{\text{i,t}-1} \quad (10)$$
$$+ \gamma year_t + \mu_i + \epsilon_{i,t}$$

The coefficient before the liquidity crisis variable will capture the main effect of liquidity risk, since the immediate reaction of investors facing liquidity shock would be to shift towards more liquid asset. The sign of this coefficient is predicted to be positive. In addition to the main effect of the liquidity risk, the interaction term between the liquidity risk and the proportion of outward FDI to all outward capital is also included to capture the effect of the mitigated adverse selection problem. As predicted by the strategic complementary hypothesis, the higher proportion of direct investors will lower the informational discount on the price of FDI and hence increase the outward FDI. Thus, the coefficient of the interaction term is expected to be negative. The set of controls will be the same as in the previous regression.

4. Estimating the Effects of Liquidity Risk on the Gross Flows of FDI and FPI

Finally, the regressions previously run on the compositions of outward FPI to FDI will be run again on the values of FPI and FDI to observe whether the results are consistent with one another.

VII. Results

1. Effects of Liquidity Risk on Stock Prices

The results of the regression of the ratio of FDI price to FPI price are presented in Table 3.3. Column 1 reveals the results of regressing the FDI to FPI price ratio on the instrumented liquidity crisis severity measure, while column 2 shows the results of regressing the price ratio

on the instrumented liquidity crisis binary variable. The overall results are consistent with the price discount hypothesis regardless of the measures of liquidity crisis used in the regressions. The higher liquidity risk negatively affects the ratio of FDI price to FPI price. This mirrored the informational discount because market participants do not know whether an FDI is sold due to liquidity shock or due to adverse productivity realization. In addition, the results showed that the higher GDP per capita (constant price) is associated with the increase in the ratio of FDI price to FPI price.

Nevertheless, when taking into account the initial portion of direct investors in the market, the regression results reveal that adverse selection problem is mitigated. Table 3.4 illustrated the results of regressing the ratio of FDI price to FPI price on the instrumented liquidity crisis variables and the interaction term between liquidity crisis and the initial portion of FDI investors. The negative coefficients of the instrumented liquidity crisis measures remained in line with the price discount hypothesis. However, the positive coefficients of the interaction term indicate that with higher initial portion of FDI investors, the higher liquidity risk can actually raise the ratio of FDI price to FPI price. This is consistent with the strategic complementarity hypothesis, which infers that the higher initial portion of direct investors will increase the probability that FDIs are sold due to liquidity shock, lowering the informational discount on the price of FDI.

2. Effect of Liquidity Risk on the Composition of Equity Flows

Table 3.5 presents the regression results of the ratio between outward FPI and FDI. Columns 1 and 2 report the fixed effects estimations, while columns 3 and 4 present the

Arellano-Bond dynamic panel estimations. The results of all the regressions in this part point toward the same direction.

The empirical results in this part appear to be in line with the predictions in Goldstein and Razin (2006) and the empirical results in Goldstein, Razin, and Tong (2007). The higher probability of liquidity crisis would lead to the higher outward FPI relative to the outward FDI, which supports the asset-liquidity hypothesis. The reason is that the higher liquidity risk in the source country increases the probability that investors from the source country may face liquidity shock and hence would not hold their investment until maturity. If that is the case, then those investors would lose from holding FDI since the selling price of FDI before maturity is lower than that of FPI due to information asymmetry. Such conjecture is supported by the positive coefficient of the instrumented liquidity crisis variable in the regressions of the outward FPI to the outward FDI. This result holds when using the liquidity crisis severity as well as the liquidity crisis dummy as the instrumented explanatory variables.

While the asset-liquidity hypothesis infers that the higher liquidity risk will result in the higher ratio of outward FPI to FDI, the strategic complementarity hypothesis indicates that the higher liquidity risk may in turn decrease the ratio of outward FPI to FDI if a country initially has high proportion of direct investors. In order to investigate whether the strategic complementarity hypothesis is consistent with the data, the ratio of outward FPI to FDI will be regressed on both the instrumented liquidity crisis variable and the interaction term between the instrumented liquidity crisis and the initial portion of direct investment (as well as other control variables). The results of the fixed effects and the dynamic panel regressions are shown in Tables 3.6 and 3.7, respectively. Only the dynamic panel results support the strategic complementarity hypothesis (neither the instrumented liquidity crisis nor the interaction term are significant in the

fixed effects regressions). In the dynamic panel regressions, the positive coefficient of the instrumented liquidity crisis still confirms that the higher liquidity risk is associated with the higher outward FPI relative to the outward FDI. On the other hand, the negative coefficient of the interaction term indicated that if a country has a higher initial portion of direct investment, the increase in liquidity risk will result in the lower ratio of outward FPI to FDI. This coincides with the mechanism that the higher proportion of direct investment will mitigate the information asymmetry problem and thus the information discount on the price of FDI, reducing the lost in selling FDI before maturity. Therefore, when facing the higher liquidity risk, investors would not have to reduce the holdings of FDI as much as before.

To examine the validity of the dynamic panel estimations, the existence of unit root in the data of FPI to FDI ratio as well as the presence of higher order auto-correlations must be determined. The coefficients of the lagged FPI to FDI in columns 3 and 4 are lower than 1, respectively, indicating that there is no unit root. Also, the Arrelano-Bond tests fail to reject the null hypothesis of no auto-correlation in the second, third, and fourth orders. Therefore, the results of the dynamic panel regressions are valid and support the theoretical predictions.

3. Effects of Liquidity Risk on Gross Flows of FDI and FPI

To explore the mechanism of the liquidity crisis and the outward international capital more thoroughly, the regression models must also be estimated separately for the levels of the outward FDI and the outward FPI. Both the fixed effects and the dynamic panel estimations for the level of the outward FDI portray the same picture. The results, which are presented in Table 3.8, indicate that after controlling for the price and other factors (including the lagged quantity in the case of dynamic panel estimation), the higher probability of liquidity crisis still has a

significant negative effect on the outward FDI, which is in line with the theoretical prediction that investors from the source country would want to hold less FDI when facing a higher probability of liquidity shock. However, the coefficients of the instrumented liquidity crisis are not significant in the regressions of the outward FPI except for the dynamic panel regression of the level of FPI using the severity measure of liquidity crisis as a regressor (see Table 3.9). Hence, it appears in the data that the liquidity crisis probability affects the composition of outward international capital mainly through the channel of outward FDI.

Overall, the findings about the effects of the liquidity risk on the prices, the compositions, and the levels of FPI and FDI are consistent with one another and support the theoretical predictions. The sale of assets in response to liquidity shock "lemons" problem helps pushing up the relative prices of FDI and FPI. More importantly, because of informational discount on the price of FDI, the rise in liquidity risk tends to reduce the holdings of FDI, thereby increasing the ratio of outward FPI and outward FDI. Nevertheless, if the proportion of direct investors is higher, the reduced "lemons" problem will drive up the demand of FDI and thus decrease the FPI to FDI ratio.

VIII. Robustness Tests

1. FDI in the Form of Mergers and Acquisitions

The interpretation of the above empirical results hinges upon a trade-off between efficiency and price discount in the investors' choices of FDI and FPI. It is not surprising that greenfield FDI investment has such attributes, since it implies greater control of investors over management, and is less liquid compared to FPI investment because of liquidation price discount. Nevertheless, the portion of FDI investment is also in the form of mergers and

acquisitions (henceforth, M&As). Such portion has recently become larger, as reflected in the 23.9 percent and 117.6 percent growth rate of net cross-border M&As in developed economies and developing economies, respectively (UNCTAD (2011)). Unlike greenfield FDI, M&As imply control over management but they are almost as liquid as FPI. Thus, the question is whether our results would still hold for FDI investment in the form of M&As.

To tackle the above question, the fixed effects and the dynamic panel regressions of the natural log of the outward FDI investment level are addressed in this section. That is, the dependent variable is the natural log of the outward M&A investment. We use UNCTAD's data of cross-border M&A purchases, which are the purchases of companies abroad by home-based transnational corporations less the sales of foreign affiliates of home based transnational corporations (UNCTAD (2010)). This data series capture the cross-border M&A investment activities by entities in the source countries.

The results of the regressions on the outward M&As (In Table 3.10) revealed that the higher probability of liquidity crisis is associated with the lower level of outward M&As (controlling for other factors). This finding in line with the implication from the regressions on the overall outward FDI as well as the theoretical prediction, inferring that investors would decide to hold less FDI as they face higher chance of liquidity shock because of the price discount disadvantage of FDI. Our results hold not only for greenfield FDI but also for M&As[15].

[15] Actually, the crux of the theory is that price discount arises from information asymmetry. When an FDI investor sells his investment, the market does not know whether he sells it because he experiences liquidity shock or because the investment is no longer fruitful. Such information asymmetry is present regardless of whether an FDI investment is in the form of greenfield or M&As.

2. Capital Account Openness

Another factor which potentially may affect a country's FDI and FPI investments is the degree of capital account liberalization[16]. Therefore, we include an additional control, the index for capital account openness, in the regression analysis. There are a number of capital account openness indices, such as Quinn (1997), Kaminsky and Schmukler (2003), Miniane (2004), and Chinn-Ito (2007). Here we use the Chinn-Ito capital account openness index, since it covers the longest data series (from 1970 to 2005). The Chinn-Ito capital account openness index is constructed based on the IMF's Annual Report on Exchange Arrangement and Exchange Restrictions (AREAER). It consists of four components; the presence of multiple exchange rates, the restrictions on current account transactions, the requirement of the surrender of export proceeds, and the restrictions on capital account transactions. The index ranges from 0 to 100, where 0 indicates the most restrictive capital account, and 100 indicates the most liberal capital account.

Tables 3.11-3.18 show that adding capital account openness as another control variable does not change the main implications of the regression results. Some of the fixed effect regressions on the ratio of the FDI price to the FPI price showed a significant negative coefficient of the capital account openness index, but such result is not robust across different specifications of liquidity crises (severity and binary variables).The fixed effect regressions on the levels of FPI and FDI indicated that the more liberalized capital account is associated with more outward FDI and FPI investments, but not the composition of outward equity flows. Indeed, regressions on the ratio of FPI and FDI did not reveal the significant effect of capital account openness.

[16] see Magud, Reihart, and Rogoff (2011), who surveyed 37 empirical studies on the effectiveness of capital controls.

IX. Conclusion

In this paper, we examine how the fear of liquidity shocks guides international investors in choosing between FPI and FDI. Our hypothesis is based on an information-efficiency trade-off (Goldstein and Razin (2006), Kirabaeva (2009)). FDI investors control the management of the firms, whereas FPI investors delegate decisions to managers. Consequently, direct investors are more informed than portfolio investors about the prospects of projects. As a consequence of a better information they are able to manage their projects, and invest in them, more efficiently. However, if investors need to liquidate investments, the price they can get will be lower whenever buyers know that the seller is more informed. The paper tests three hypotheses concerning foreign equity investment in the presence of liquidity risk. First, the FDI-to-FPI price differential is negatively related to liquidity risk (the "Price Discount Hypothesis"). The idea is that market participants do not know whether the FDI investor liquidates a firm because of an idiosyncratic liquidity shock, or because, as an informed investor, the firm is hit by a productivity shock. Second, the FDI-to-FPI composition of foreign equity investment skews towards FPI, if investors are expected to experience liquidity shortage in the future (the "Equity-Composition Hypothesis"). The idea is that because direct investments are more costly to liquidate, due to the price discount, the more severe is the expected liquidity shock, the smaller is the FDI-to-FPI ratio. Third, the FDI-to-FPI composition of foreign equity flows skews towards FDI, the larger are past FDI-to-FPI stocks (the "Strategic Complementarity Hypothesis"). The idea is that high liquidity need investors generate a positive information-externality for low liquidity need investors among investors who choose FDI, and further increases in the number of FDI investors comes from mainly high liquidity need investors. Such an increase reinforces the

information externality, thereby lowering the FDI-to-FPI price discount, creating further incentives for investors to choose FDI. The paper brings these hypotheses to country level data consisting of a large set of developed and developing countries over the period 1970 to 2004. The evidence gives strong support to the hypotheses: greater liquidity risk increases the price discount, has a negative effect on gross flows of FDI, and has a positive effect on the ratio between FPI and FDI.

X. Appendix B

Table 3.1: Summary Statistics for Dependent Variables, Variables of Interest, Instruments, and Controls

Summary Statistics For Dependent Variables					
Variable	Obs	Mean	Std. Dev.	Min	Max
ln(outward FPI / outward FDI)	1708	-0.98	1.72	-8.32	4.36
ln(outward FDI)	2199	6.44	3.39	-3.91	15.01
ln(outward FPI)	1753	6.25	3.44	-4.61	14.74
ln(inward FPI / inward FDI)	1725	-2.13	1.95	-11.47	2.89
ln(inward FDI)	2475	8.07	2.29	1.42	14.84
ln(inward FPI)	1725	6.81	3.41	-3.91	14.54

Summary Statistics For Variables of Interest					
Variable	Obs	Mean	Std. Dev.	Min	Max
Liquidity crisis dummy	2436	0.17	0.38	0	1
Liquidity crisis dummy*(FDI/all inward capital)$_{i,t-1}$	2235	0.16	0.35	0	1
Truncated liquidity crisis severity	2399	0.02	0.09	0	2.73
Truncated liquidity crisis severity*(FDI/all inward capital)$_{i,t-1}$	2232	0.02	0.10	0	2.73

Summary Statistics For Instruments					
Variable	Obs	Mean	Std. Dev.	Min	Max
Current Account Balance/GDP	2463	-2.26	6.32	-28.76	22.42
Govt. Budget Balance/GDP	1892	-0.03	0.05	-1	0.19
ICRG financial risk index	1602	35.13	8.50	10	50
ICRG political risk index	1602	67.31	14.81	27	97

Summary Statistics For Controls					
Variable	Obs	Mean	Std. Dev.	Min	Max
Log of GDP	1723	5.90	2.96	-4.61	14.65
Log of GDP Per Capita	1716	8.04	1.52	4.82	10.79
Log of Stock Market Capitalization	1108	-1.55	1.36	-8.46	1.57
Trade Openness	1680	4.16	0.56	2.53	5.93
Real Exchange Rate	1199	103.82	24.99	41.75	354.96
Lag of Real Exchange Rate	1189	4.63	0.22	3.73	5.87
GDP deflator	1715	1517.7	14680.7	1.00E-07	314948.7

Table 3.2: Pair-Wise Correlations between the Variables of Interest and the Instruments

	Current account balance to GDP	Government budget balance to GDP	Percentage of short-term debt	ICRG financial risk index	ICRG political risk index
Liquidity crisis dummy	-0.1722	-0.1266	-0.0108	-0.2576	-0.2553
Liquidity crisis dummy*Initial inward FDI portion	-0.1157	-0.0112	0.035	-0.0983	-0.1362
Truncated liquidity crisis severity	-0.1094	-0.0655	0.0196	-0.207	-0.1958
Liquidity crisis severity*Initial inward FDI portion	-0.1088	0.0015	0.0281	-0.1289	-0.1496

Table 3.3: The Effect of the Liquidity Crisis on the FDI to FPI Price Ratio (Fixed Effects)

	Severity	**Binary**
Instrumented liquidity crisis	-48.29**	-5.05**
	20.97	*2.12*
Log of GDP	-0.31	-2.43
	0.19	*2.76*
Log of GDP per capita (constant price)	3.74***	2.52**
	1.39	*1.17*
GDP deflator	0.010	-0.003
	0.028	*0.027*
Numbers of observation	458	458
Numbers of countries	47	47
Underidentification test (Anderson canon. corr. LM statistic)	5.769	7.21
P-value	0.0559	0.0655
Sargan Statistic (overidentification test of all instruments)	1.895	4.258
P-value	0.1686	0.1189

The dependent variable is the log of the price of FDI over the price of FPI. The country and time fixed effects are included in both equations. The italic numbers are the standard deviations.

Table 3.4: The Effect of the Liquidity Crisis and the Initial Direct Investment Portion on the FDI Price to FPI Price Ratio

	Severity	**Binary**
Instrumented liquidity crisis	-47.49**	-12.03**
	22.10	*5.32*
Instrumented liquidity crisis*initial direct investment portion	258.96*	36.41*
	153.57	*22.12*
Initial direct investment portion	-0.57	1.53
	1.83	*4.11*
Log of GDP	-4.62***	-8.10**
	1.07	*2.59*
Log of GDP per capita (constant price)	4.42**	11.25***
	1.89	*4.28*
GDP deflator	38.21***	61.63***
	11.69	*23.05*
Numbers of observation	356	343
Numbers of countries	40	39
Underidentification test (Anderson canon. corr. LM statistic)	5.843	5.168
P-value	0.0538	0.0755
Sargan Statistic (overidentification test of all instruments)	0.155	1.097
P-value	0.6935	0.2949

The dependent variable is the log of the price of FDI over the price of FPI. The country and time fixed effects are included in both equations. The italic numbers are the standard deviations.

Table 3.5: The Effect of the Liquidity Crisis on the Outward FPI to FDI Ratio

	Fixed Effects		Dynamic Panel	
	Severity	**Binary**	**Severity**	**Binary**
Instrumented liquidity crisis	17.40*	1.10*	2.30**	0.35*
	8.92	*0.67*	*0.93*	*0.93*
Log of GDP	-1.83**	-1.96**	-0.02*	-0.02
	0.93	*0.79*	*0.01*	*0.01*
Log of GDP per capita (constant price)	-2.06***	-2.69***	-0.01	-0.01
	0.40	*0.40*	*0.04*	*0.04*
Log of stock market capitalization	0.23***	0.16**	-0.01	-0.01
	0.07	*0.06*	*0.03*	*0.03*
Trade openness	-1.11***	-1.25***	-0.04	-0.04
	0.31	*0.27*	*0.04*	*0.04*
Real exchange rate (lag)	-2.56***	-2.28***	-0.21	-0.21
	0.38	*0.28*	*-0.19*	*0.19*
GDP deflator	-0.014***	-0.014***	-0.001**	-0.001**
	0.002	*0.002*	*0.001*	*0.001*
Lag of outward FPI to FDI ratio			0.91***	0.91***
			0.03	*0.03*
Numbers of observation	694	719	330	337
Numbers of countries	56	56	31	31
Underidentification test (Anderson canon. corr. LM statistic)	11.005	16.288		
P-value	0.027	0.0003		
Sargan Statistic (overidentification test of all instruments)	4.845	2.206		
P-value	0.184	0.138		
Hansen test of overid. restrictions			8.740	0.020
P-value			0.120	1.000

Table 3.6: The Effect of Liquidity Crisis and Initial Direct Investment Portion on the Outward FPI to FDI Ratio (Fixed Effects)

	Severity	Binary
Instrumented liquidity crisis	-15.04	-0.45
	12.36	0.75
Instrumented liquidity crisis*initial direct investment portion	-22.95	-0.89
	68.95	4.13
Initial direct investment portion	-3.90***	-4.72***
	0.63	0.88
Log of GDP	-0.30***	-0.43***
	0.09	0.16
Log of GDP per capita (constant price)	0.29	0.17
	0.62	0.66
Log of stock market capitalization	0.39***	0.27**
	0.09	0.12
Trade openness	-0.69*	-1.13*
	0.37	0.59
Real exchange rate (lag)	-0.79**	-0.24
	0.37	0.44
GDP deflator	-0.004	-0.002
	0.002	0.002
Numbers of observation	497	199
Numbers of countries	51	27
Underidentification test (Anderson canon. corr. LM statistic)	6.074	10.122
P-value	0.108	0.018
Sargan Statistic (overidentification test of all instruments)	3.208	1.986
P-value	0.201	0.370

Table 3.7: The Effect of Liquidity Crisis and Initial Direct Investment Portion on the Outward FPI to FDI Ratio (Dynamic Panel)

	Severity	Binary
Instrumented liquidity crisis	2.03***	0.42*
	0.58	*0.58*
Instrumented liquidity crisis*initial direct investment portion	-12.47**	-12.47*
	5.87	*5.87*
Initial direct investment portion	0.25	0.25
	0.23	*0.23*
Log of GDP	-0.02**	-0.02*
	0.01	*0.01*
Log of GDP per capita (constant price)	0.04*	0.04**
	0.02	*0.02*
Log of stock market capitalization	0.00	0.00
	0.03	*0.03*
Trade openness	0.01	0.01
	0.04	*0.04*
Real exchange rate (lag)	-0.30*	-0.30
	0.17	*0.17*
GDP deflator	-0.0009**	-0.0009**
	0.0004	*0.0004*
Lag of outward FPI to FDI ratio	0.90***	0.90***
	0.04	*0.04*
Numbers of observation	499	495
Numbers of countries	54	54
Hansen test of overid. restrictions	16.49	16.53
P-value	0.124	0.123

Table 3.8: The Effect of the Liquidity Crisis on the Level of the Outward FDI

	Fixed Effects		Dynamic Panel	
	Severity	**Binary**	**Severity**	**Binary**
Instrumented liquidity crisis	-19.20**	-1.88**	-0.67*	-0.74*
	9.01	*0.90*	*0.37*	*0.37*
Log of GDP	-0.66	-0.54	0.02***	0.02***
	0.82	*0.80*	*0.01*	*0.01*
Log of GDP per capita (constant price)	2.68*	2.54***	0.06***	0.06***
	0.37	*0.36*	*0.03*	*0.03*
Log of stock market capitalization	0.04	0.11*	0.05***	0.05***
	0.06	*0.06*	*0.02*	*0.02*
Trade openness	0.67**	0.57**	-0.09**	-0.09***
	0.27	*0.26*	*0.03*	*0.03*
Real exchange rate (lag)	1.56***	1.04***	0.08	0.08
	0.32	*0.24*	*-0.08*	*0.08*
GDP deflator	0.012***	0.012***	0.0003	0.0004
	0.002	*0.002*	*0.0003*	*0.0003*
Lag of the level of outward FDI			0.95***	0.95***
			0.01	*0.01*
Numbers of observation	760	787	394	410
Numbers of countries	58	59	32	32
Underidentification test (Anderson canon. corr. LM statistic)	7.946	7.798		
P-value	0.047	0.0203		
Sargan Statistic (overidentification test of all instruments)	1.536	0.639		
P-value	0.464	0.424		
Hansen test of overid. restrictions			13.320	9.770
P-value			0.206	0.202

Table 3.9: The Effect of Liquidity Crisis on the Level of the Outward FPI

	Fixed Effects		Dynamic Panel	
	Severity	**Binary**	**Severity**	**Binary**
Instrumented liquidity crisis	-1.65	-0.05	1.36**	0.19
	5.44	*0.44*	*0.65*	*0.65*
Log of GDP	-2.21***	-2.17***	0.00	0.00
	0.57	*0.55*	*0.01*	*0.01*
Log of GDP per capita (constant price)	0.62**	0.60**	0.06	0.06
	0.24	*0.25*	*0.05*	*0.05*
Log of stock market capitalization	0.31***	0.32***	0.05	0.05
	0.04	*0.04*	*0.04*	*0.04*
Trade openness	-0.35*	-0.34*	-0.14**	-0.14***
	0.19	*0.19*	*0.06*	*0.06*
Real exchange rate (lag)	-0.78***	-0.82***	-0.09	-0.09
	0.23	*0.19*	*-0.13*	*0.13*
GDP deflator	-0.001	-0.002	-0.001	-0.001
	0.001	*0.001*	*0.001*	*0.001*
Lag of the level of outward FPI			0.93***	0.93***
			0.05	*0.05*
Numbers of observation	695	696	343	343
Numbers of countries	56	56	31	31
Underidentification test (Anderson canon. corr. LM statistic)	10.873	16.660		
P-value	0.012	0.0008		
Sargan Statistic (overidentification test of all instruments)	1.609	1.706		
P-value	0.447	0.426		
Hansen test of overid. restrictions			4.230	3.330
P-value			0.836	0.912

Table 3.10: The Effect of Liquidity Crisis on the Level of the M&As

	Fixed Effects		Dynamic Panel	
	Severity	**Binary**	**Severity**	**Binary**
Instrumented liquidity crisis	-34.86	-6.95*	-7.87*	-0.73*
	32.02	4.2	4.1	0.44
Log of GDP	-1.09	-4.2	-0.03	-0.009
	3.03	4.12	0.08	0.09
Log of GDP per capita (constant price)	4.55***	4.94***	0.11	0.21
	1.2	1.6	0.35	0.39
Log of stock market capitalization	0.42**	0.63**	1.00***	1.20***
	0.19	0.29	0.29	0.3
Trade openness	-0.76	-1.26	-0.74**	-0.89**
	1.21	1.43	0.33	0.4
Real exchange rate (lag)	-1.47*	-2.44**	-1.92**	-2.02**
	0.81	1.13	0.71	0.82
GDP deflator	-0.0048	-0.0001	0.0095***	0.0135***
	0.006	0.008	0.003	0.003
Lag of the level of M&As			0.17*	-0.061
			0.1	0.08
Numbers of observation	597	598	210	210
Numbers of countries	55	55	28	23
Underidentification test (Anderson canon. corr. LM statistic)	6.147	5.188		
P-value	0.1	0.0747		
Sargan Statistic (overidentification test of all instruments)	3.949	0.076		
P-value	0.139	0.783		
Hansen test of overid. restrictions			12.99	13.74
P-value			0.224	0.132

Table 3.11: The Effect of Liquidity Crisis on the FDI to FPI Price Ratio (Fixed Effects with Capital Account Openness)

	Severity	**Binary**
Instrumented liquidity crisis	-47.71**	-5.21**
	16.86	2.06
Log of GDP	-5.66*	-2.33
	3.25	2.84
Log of GDP per capita (constant price)	3.65***	2.82**
	1.35	1.28
GDP deflator	0.012	0.0001
	0.03	0.03
Capital account openness	-0.30**	-0.17
	0.14	0.12
Numbers of observation	448	448
Numbers of countries	47	47
Underidentification test (Anderson canon. corr. LM statistic)	8.766	8.037
P-value	0.033	0.018
Sargan Statistic (overidentification test of all instruments)	4.422	1.172
P-value	0.11	0.279

The dependent variable is the log of the price of FDI over the price of FPI. The country and time fixed effects are included in both equations. The italic numbers are the standard deviations.

Table 3.12: The Effect of Liquidity Crisis and Initial Direct Investment Portion on the FDI Price to FPI Price Ratio (Fixed Effects with Capital Account Openness)

	Severity	Binary
Instrumented liquidity crisis	-50.71**	-16.39**
	25.75	7.01
Instrumented liquidity crisis*initial direct investment portion	303.56*	57.06**
	172.12	27.6
Initial direct investment portion	-1.32	-0.86
	1.89	4.93
Log of GDP	-5.12***	-9.97***
	1.2	3.33
Log of GDP per capita (constant price)	4.74**	14.21**
	2.3	6.05
GDP deflator	47.31***	83.72***
	12.84	31.06
Capital account openness	-0.17	-0.48*
	0.14	0.28
Numbers of observation	345	333
Numbers of countries	40	39
Underidentification test (Anderson canon. corr. LM statistic)	5.916	6.176
P-value	0.05	0.1
Sargan Statistic (overidentification test of all instruments)	0.607	0.719
P-value	0.436	0.699

The dependent variable is the log of the price of FDI over the price of FPI. The country and time fixed effects are included in both equations. The italic numbers are the standard deviations

Table 3.13: The Effect of Liquidity Crisis on the Outward FPI to FDI Ratio (with Capital Account Openness)

	Fixed Effects		Dynamic Panel	
	Severity	**Binary**	**Severity**	**Binary**
Instrumented liquidity crisis	17.41*	1.21*	2.11*	0.15
	9.13	0.69	1.18	0.19
Log of GDP	-2.26**	-2.24***	-0.03**	-0.03**
	0.97	0.84	0.01	0.01
Log of GDP per capita (constant price)	-2.18***	-2.82***	0.05	0.04
	0.4	0.41	0.03	0.03
Log of stock market capitalization	0.25***	0.16**	0.009	0.004
	0.07	0.07	0.02	0.03
Trade openness	-1.12***	-1.25***	-0.07	-0.07
	0.31	0.28	0.05	0.05
Real exchange rate (lag)	-2.46***	-2.22***	-0.32*	-0.29*
	0.39	0.3	0.16	0.17
GDP deflator	-0.014***	-0.014***	-0.001**	-0.001**
	0.002	0.002	0.0004	0.0004
Capital account openness	-0.06	-0.03	-0.003	0.001
	0.05	0.05	0.02	0.02
Lag of outward FPI to FDI ratio			0.83***	0.83***
			0.04	0.03
Numbers of observation	684	709	656	666
Numbers of countries	56	56	57	57
Underidentification test (Anderson canon. corr. LM statistic)	10.458	16.162		
P-value	0.0334	0.0003		
Sargan Statistic (overidentification test of all instruments)	3.6	2.101		
P-value	0.308	0.147		
Hansen test of overid. restrictions			6.82	5.07
P-value			0.448	0.535

Table 3.14: The Effect of Liquidity Crisis and Initial Direct Investment Portion on the Outward FPI to FDI Ratio (Fixed Effects with Capital Account Openness)

	Severity	Binary
Instrumented liquidity crisis	-17.22	0.18
	14.51	0.7
Instrumented liquidity crisis*initial direct investment portion	-23.72	-4.5
	75.88	3.79
Initial direct investment portion	-4.02***	-4.79***
	0.68	0.86
Log of GDP	-0.33***	-0.47***
	0.11	0.16
Log of GDP per capita (constant price)	0.34	0.24
	0.69	0.65
Log of stock market capitalization	0.42***	0.24*
	0.1	0.12
Trade openness	-0.68*	-0.67*
	0.4	0.59
Real exchange rate (lag)	-0.73*	-0.3
	0.4	0.42
GDP deflator	-0.003	-0.001
	0.003	0.002
Capital account openness	0.07	0.11**
	0.05	0.05
Numbers of observation	487	196
Numbers of countries	51	27
Underidentification test (Anderson canon. corr. LM statistic)	6.074	10.77
P-value	0.082	0.013
Sargan Statistic (overidentification test of all instruments)	0.201	2.223
P-value	0.654	0.329

Table 3.15: The Effect of Liquidity Crisis and Initial Direct Investment Portion on the Outward FPI to FDI Ratio (Dynamic Panel with Capital Account Openness)

	Severity	Binary
Instrumented liquidity crisis	2.02***	0.43*
	0.54	0.25
Instrumented liquidity crisis*initial direct investment portion	-11.32*	-1.29*
	6.42	0.67
Initial direct investment portion	0.3	0.37
	0.23	0.23
Log of GDP	-0.02*	-0.02*
	0.01	0.01
Log of GDP per capita (constant price)	0.12	0.13
	0.25	0.15
Log of stock market capitalization	-0.002	-0.01
	0.03	0.02
Trade openness	-0.02	-0.02
	0.06	0.05
Real exchange rate (lag)	-0.21	-0.21
	0.31	0.22
GDP deflator	-0.001	-0.001
	0.001	0.001
Capital account openness	-0.1	-0.1
	0.28	0.16
Lag of outward FPI to FDI ratio	0.90***	0.90***
	0.04	0.04
Numbers of observation	488	484
Numbers of countries	53	53
Hansen test of overid. restrictions	15.14	10.9
P-value	0.127	0.366

Table 3.16: The Effect of Liquidity Crisis on the Level of the Outward FDI (with Capital Account Openness)

	Fixed Effects		Dynamic Panel	
	Severity	**Binary**	**Severity**	**Binary**
Instrumented liquidity crisis	-20.09**	-1.89**	-0.68*	-0.07**
	9.36	0.92	0.37	0.37
Log of GDP	0.07	0.12	0.02**	0.02***
	0.87	0.85	0.01	0.01
Log of GDP per capita (constant price)	2.89***	2.74***	0.07**	0.06***
	0.38	0.35	0.03	0.03
Log of stock market capitalization	0.01	0.09	0.06***	0.05***
	0.06	0.06	0.02	0.02
Trade openness	0.70**	0.62**	-0.08*	-0.09**
	0.28	0.26	0.03	0.03
Real exchange rate (lag)	1.37***	0.88***	0.07	0.04
	0.33	0.25	0.08	0.08
GDP deflator	0.01***	0.01***	0.0004	0.0003
	0.002	0.002	0.0003	0.0003
Capital account openness	0.15***	0.13***	-0.00003	-0.0005
	0.04	0.05	0.01	0.01
Lag of the level of outward FDI			0.95***	0.95***
			0.01	0.01
Numbers of observation	750	777	391	391
Numbers of countries	58	59	32	32
Underidentification test (Anderson canon. corr. LM statistic)	7.662	7.496		
P-value	0.054	0.024		
Sargan Statistic (overidentification test of all instruments)	3.134	0.002		
P-value	0.209	0.962		
Hansen test of overid. restrictions			10.63	12.03
P-value			0.387	0.15

Table 3.17: The Effect of Liquidity Crisis on the Level of the Outward FPI (with Capital Account Openness)

	Fixed Effects		Dynamic Panel	
	Severity	**Binary**	**Severity**	**Binary**
Instrumented liquidity crisis	-3.12	-0.15	1.33	0.13
	5.53	0.58	1.03	0.19
Log of GDP	-1.91***	-2.09***	0.0002	0.001
	0.58	0.62	0.01	0.01
Log of GDP per capita (constant price)	0.74***	0.43*	0.11*	0.11*
	0.25	0.25	0.06	0.06
Log of stock market capitalization	0.30***	0.28***	0.09*	0.09*
	0.04	0.05	0.05	0.05
Trade openness	-0.33*	-0.11	-0.18**	-0.18***
	0.19	0.18	0.08	0.06
Real exchange rate (lag)	-0.90*	-0.44**	-0.21	-0.17
	0.24	0.2	0.08	0.15
GDP deflator	-0.001	-0.0002	-0.001	-0.001
	0.001	0.001	0.001	0.001
Capital account openness	0.11***	0.08**	-0.04	-0.04
	0.03	0.03	0.02	0.02
Lag of the level of outward FPI			0.87***	0.88***
			0.06	0.05
Numbers of observation	685	715	339	339
Numbers of countries	56	57	31	31
Underidentification test (Anderson canon. corr. LM statistic)	10.35	9.636		
P-value	0.016	0.022		
Sargan Statistic (overidentification test of all instruments)	4.364	4.466		
P-value	0.113	0.11		
Hansen test of overid. restrictions			1.65	1.42
P-value			0.977	0.965

Table 3.18: The Effect of Liquidity Crisis on the Level of the M&As (with Capital Account Openness)

	Fixed Effects		Dynamic Panel	
	Severity	**Binary**	**Severity**	**Binary**
Instrumented liquidity crisis	-28.09	-7.17*	-8.19**	-0.79*
	29.39	4.38	4.08	0.46
Log of GDP	-0.42	-3.08	-0.03	-0.013
	2.91	4.25	0.09	0.09
Log of GDP per capita (constant price)	4.82***	5.33***	0.07	0.19
	2.91	1.68	0.38	0.42
Log of stock market capitalization	0.38**	0.62**	1.00***	1.20***
	0.18	0.3	0.3	0.31
Trade openness	-0.55	-1.28	-0.74**	-0.87**
	1.15	1.48	0.34	0.41
Real exchange rate (lag)	-1.84**	-2.76**	-2.04**	-2.18**
	0.79	1.19	0.85	0.92
GDP deflator	-0.005	-0.0004	-0.009***	0.013***
	0.005	0.009	0.003	0.003
Capital account openness	0.19*	0.18	0.07	0.04
	0.12	0.16	0.22	0.23
Lag of the level of M&As			0.17*	-0.06
			0.09	0.08
Numbers of observation	588	589	208	208
Numbers of countries	55	55	28	28
Underidentification test (Anderson canon. corr. LM statistic)	6.736	4.936		
P-value	0.081	0.085		
Sargan Statistic (overidentification test of all instruments)	4.131	0.003		
P-value	0.127	0.954		
Hansen test of overid. restrictions			12.65	9.66
P-value			0.244	0.379

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